Tragedy Fires: What Can We Learn in the Weather Community?

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NOAA – National Weather Service, Seattle

Twisp and the System of Wildland Firefighting

There is a deep need after any fatality event to understand what happened so that everything possible can be done to prevent another occurrence. Prevention is not as easy as learning what people should or should not have done at a specific incident. It requires a thorough examination of the system that put people in positions where they felt that their actions were the best option. Between 1910 and 2014[2] the wildland firefighting community lost 1,075 firefighters. This unacceptable loss forces us to reflect on our processes and system of work.

From the Twisp River Fatalities and Entrapments,
Interagency Learning Review Status Report, Nov. 2015

What do these entrapment fires have in common?

- Thirtymile Fire (2001)
- Yarnell Hill Fire (2013)
- Beaver Fire (2014)
- Frog Fire (2015)
- Twisp River Fire (2015)

All Had **Multiple** Contributing Factors,

of which weather was one

18 Watchouts Situations

1. Fire not scouted and sized up.
2. In country not seen in daylight.
3. Safety zones and escape routes not identified.
4. Unfamiliar with weather and local factors influencing fire behavior.
5. Uninformed on strategy, tactics, and hazards.
6. Instructions and assignments not clear.
7. No communication link with crewmembers/supervisors.
8. Constructing line without safe anchor point.
9. Building fireline downhill with fire below.
10. Attempting frontal assault on fire.
11. Unburned fuel between you and the fire.
12. Cannot see main fire, not in contact with anyone who can.
13. On a hillside where rolling material can ignite fuel below.
14. Weather is getting hotter and drier.
15. Wind increases and/or changes direction.
16. Getting frequent spot fires across line.
17. Terrain and fuels make escape to safety zones difficult.
18. Taking a nap near the fire line.

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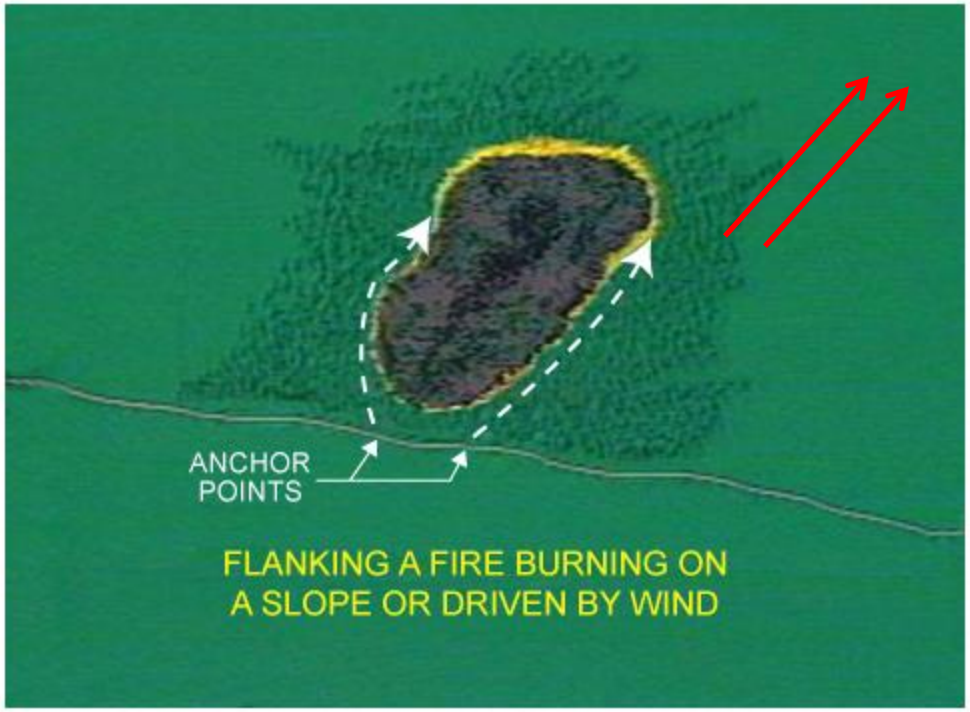
Weather is often a contributing factor but is *never* the lone cause of entrapments

Unit 10: Fire Behavior Affects Fireline Tactics

:: Back

Flanking a Fire

The figure below illustrates the basic tactics of flanking a fire burning on a slope or driven by wind. Firelines, starting from the rear of the fire, are located and constructed along either flank as close to the fire as possible. As fireline construction progresses, the line is burned out or the main fire is allowed to burn clean to the constructed line. Eventually, line construction will catch up with the head and pinch it off at an advantageous time. It's essential to have firelines anchored to a safety zone, or to create safety zones as work progresses along the flanks.



Credit: Utah State University

ANCHOR

FLANK

PINCH OFF THE HEAD

Understanding Wildland Firefighters

- Since the 1990 Dude Fire killed 6 firefighters near Payson, Arizona, firefighting culture has evolved to a **Safety First** mindset

Understanding Wildland Firefighters

Weather Observations Taken Hourly and Reported throughout Division

Understanding Wildland Firefighters

The meteorologist has the firefighters' attention

6 AM Briefing on the South Complex, Hyampom, California, August 9, 2015

Understanding Wildland Firefighters

Important to Keep in Mind:

Every firefighter who dies arrives at that point through a series of decisions in which he/she thinks they are doing what is best.

From the Thirtymile Fire Accident Investigation Report (2001)

Standard Fire Orders

All ten Standard Fire Orders were violated or disregarded at one time or another during the course of the incident. The following are some examples of these situations.

1. **Fight fire aggressively but provide for safety first.**

   The tactics implemented provided for aggressive suppression but lacked critical safety procedures, including mandatory escape routes.

2. **Initiate all actions based on current and expected fire behavior.**

   Aggressive attack with over-extended resources continued in spite of onsite indicators of an increased rate of spread, multiple spots, and crown fire.

3. **Recognize current weather conditions and obtain forecasts.**

   - Although received by Okanogan Dispatch, no afternoon fire weather forecast was transmitted to the Thirtymile Fire or the Methow Valley District.
   - No Spot Weather Forecast was requested by management or incident commanders.

4. **Ensure that instructions are given and understood.**

From the Thirtymile Fire Accident Investigation Report (2001)

Watch Out Situations

The following ten Watch Out Situations were present or disregarded at one time or another during the course of the incident as evidenced by the following non-inclusive set of examples.

Safety zones and escape routes not identified ***(Watch Out Situation # 3)***

- When they were working on the spots there was no clear instruction on safety zones or escape routes.
- The lunch site was not a safety zone and there were no safety zones up canyon from the point of the fire origin once the fire behavior became severe.
- The shelter deployment site was not a safety zone.

Unfamiliar with weather and local factors influencing fire behavior ***(Watch Out Situation # 4)***

- Fire fighters were unaware of the near record ERC readings and how that affected fire behavior.

Uninformed about strategy tactics and hazards ***(Watch Out Situation # 5)***

- Chosen strategy and tactics were not achievable or viable due to fuel and environmental conditions.
- Hazards were never properly recognized, evaluated, and addressed

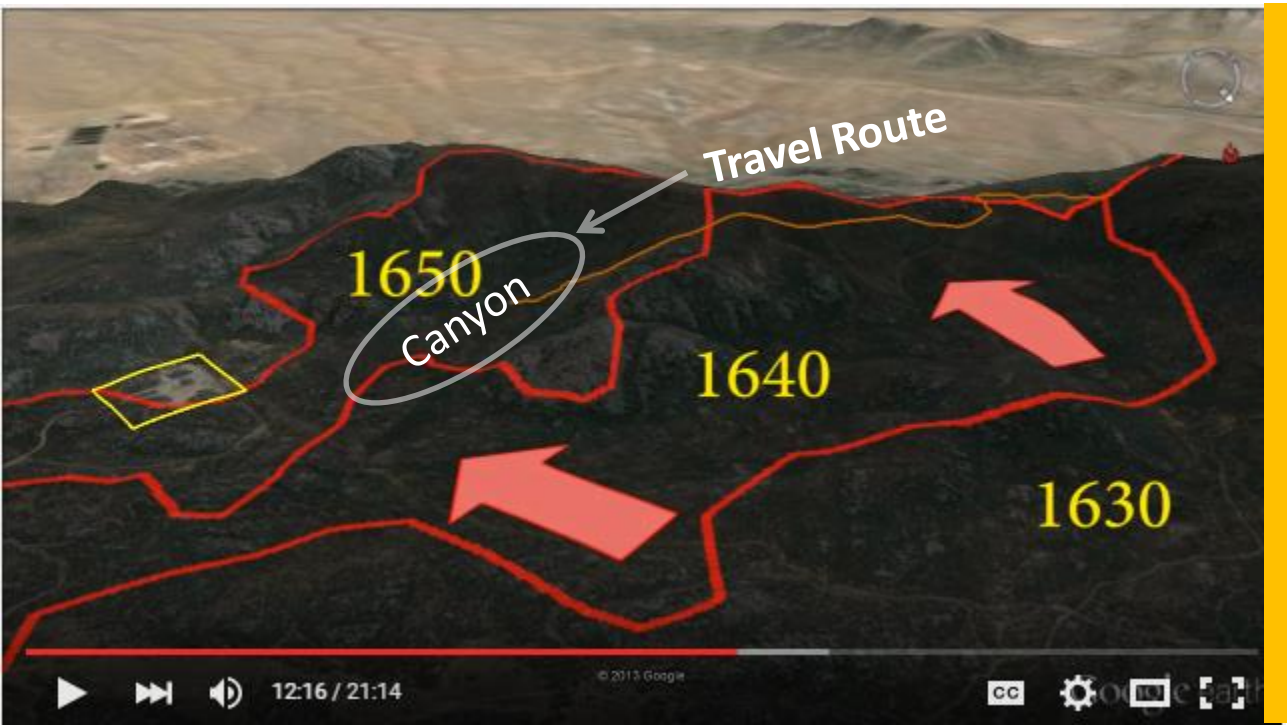
Photo by Sandor A. Feher, Winthrop, WA

The Thirtymile Fire in the late afternoon (~ 5:30 p.m. PDT), July 10, 2001

Yarnell Hill Tragedy – 2013
19 members of Granite Mtn. Hotshot Crew Perish

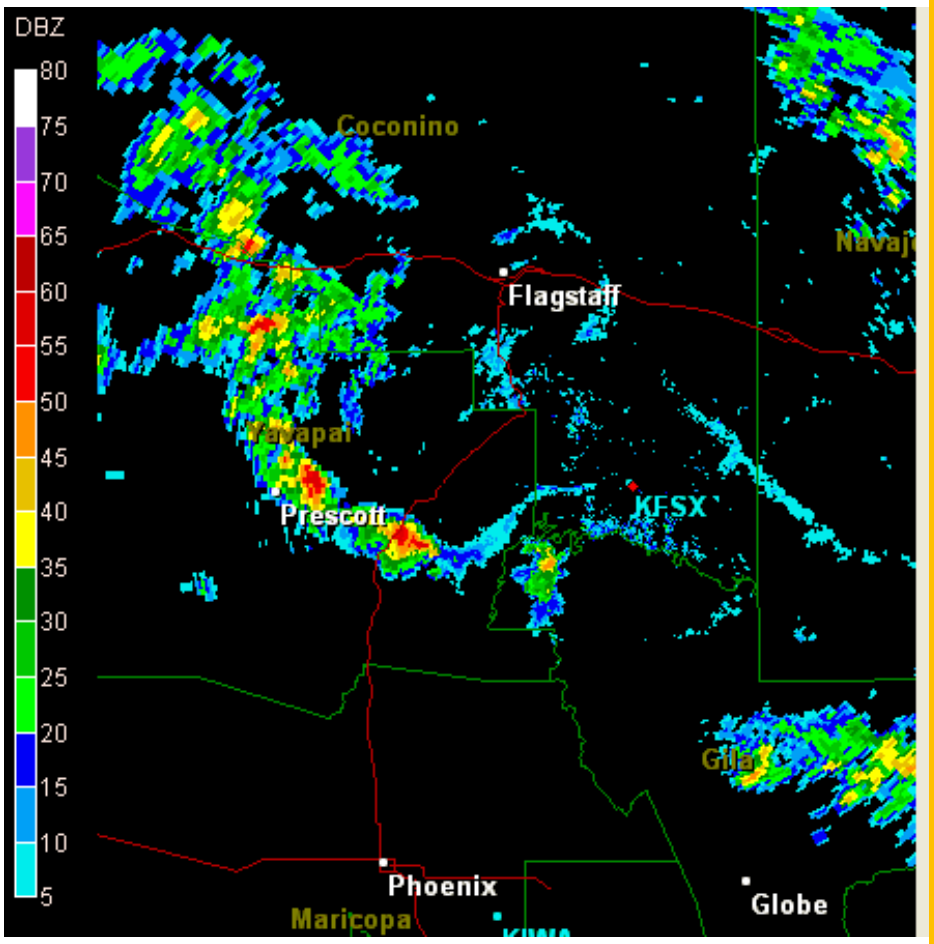
Deadliest wildland firefighting tragedy since 1933
Deadliest firefighting tragedy since Sep. 11 attacks, 2001

Credit: untamedskies.com



- Rate of spread tripled after outflow boundary arrival

Will never know the whole story, but…

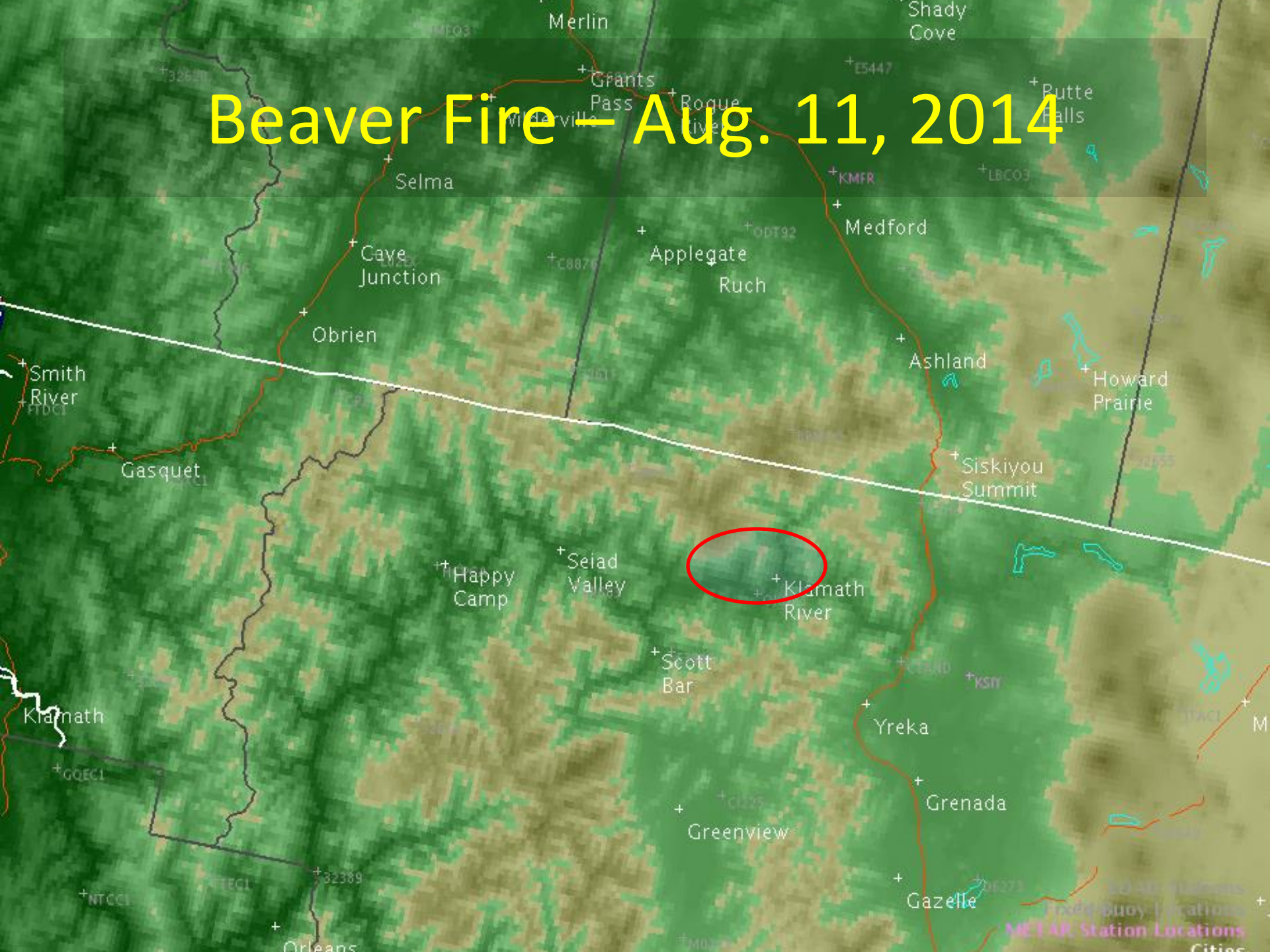


- Were earlier informed that outflow boundary was coming
- Observed a benign non-outflow wind shift
- Were they uncertain if this was THE outflow boundary or not???
- *<u>Could they have better assessed risk</u> if they had:*

1) Seen this radar loop?
2) Interpreted it accurately?
3) Called the NWS directly?

Inspired by Yarnell Hill

- NWS Seattle taught hundreds of firefighters how to interpret outflow boundaries using radar data


Beaver Fire – Aug. 11, 2014
Merlin
Shady Cove
Grants Pass
Rogue
Butte Falls
Selma
Medford
Cave Junction
Applegate
Ruch
Obrien
Ashland
Howard Prairie
Smith River
Gasquet
Siskiyou Summit
Happy Camp
Seiad Valley
Klamath River
Scott Bar
Klamath
Yreka
Grenada
Greenview
Gazelle
Orleans


“This is a Critical Fire Weather Day”
“Red Flag Warning is in effect”
Tim Sedlock, IMET Trainee
0600 Weather Briefing
8/11/2014

IMET Radio Updates

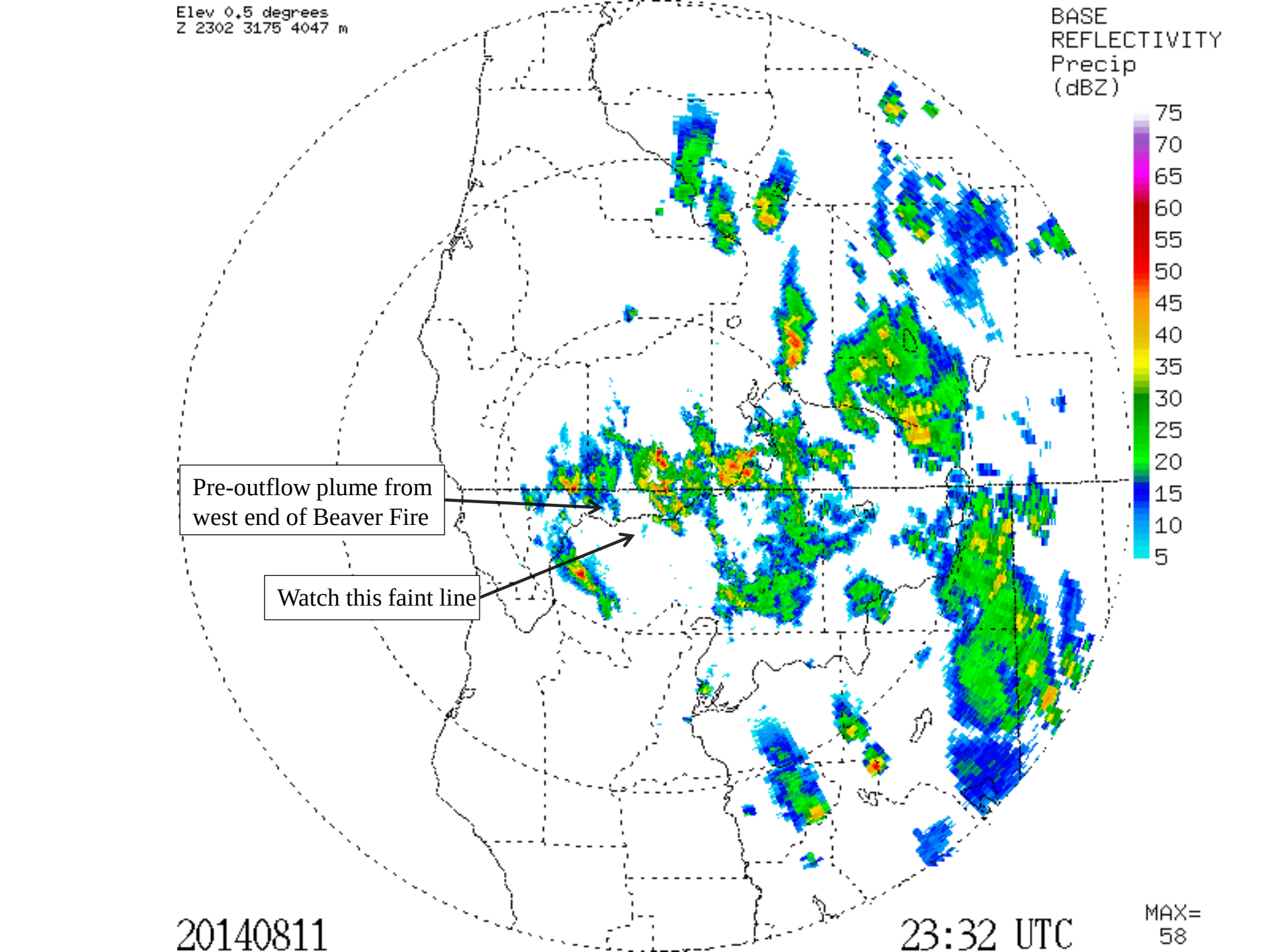
- 1100 – First Scripted Radio Update to address passing virga shower
- 1200 – Nothing now, T-storm activity could impact fire later this afternoon
- 1310 – Storms developing in distant southeast
- 1410 – “Thunderstorms making their push toward the fire”, arrival around 1500


1501 PDT, August 11
Looking north from ICP
“Is that a bulldozer??!!”

IMET Radio Updates

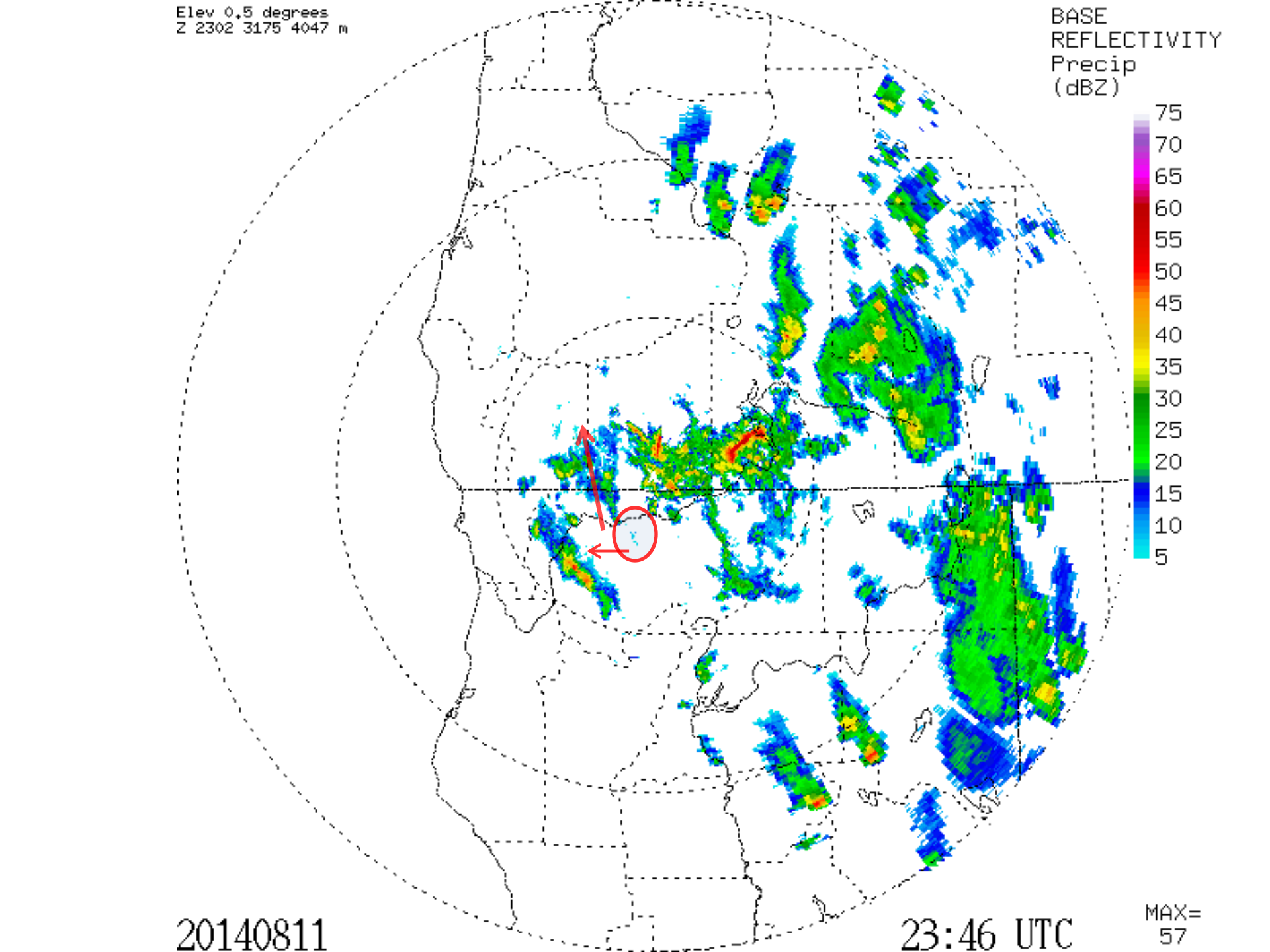
- 1509 – NWS has issued a Severe Thunderstorm Warning. Quarter-sized hail and 60 mph wind gusts. Storm core will pass over Branch II. "This is a serious weather situation".

  – Prompted most divisions to pull personnel from fireline back to safety


Elev 0.5 degrees
Z 2302 3175 4047 m
BASE
REFLECTIVITY
Precip
(dBZ)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
Pre-outflow plume from
west end of Beaver Fire
Watch this faint line
20140811
23:32 UTC
MAX=
58

Radio Update

- 1635 – Dissipating storms east of the fire could push easterly outflow winds of 30-35 mph across fire. Branch II most likely affected.


Elev 0.5 degrees
Z 2302 3175 4047 m
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REFLECTIVITY
Precip
(dBZ)
75
70
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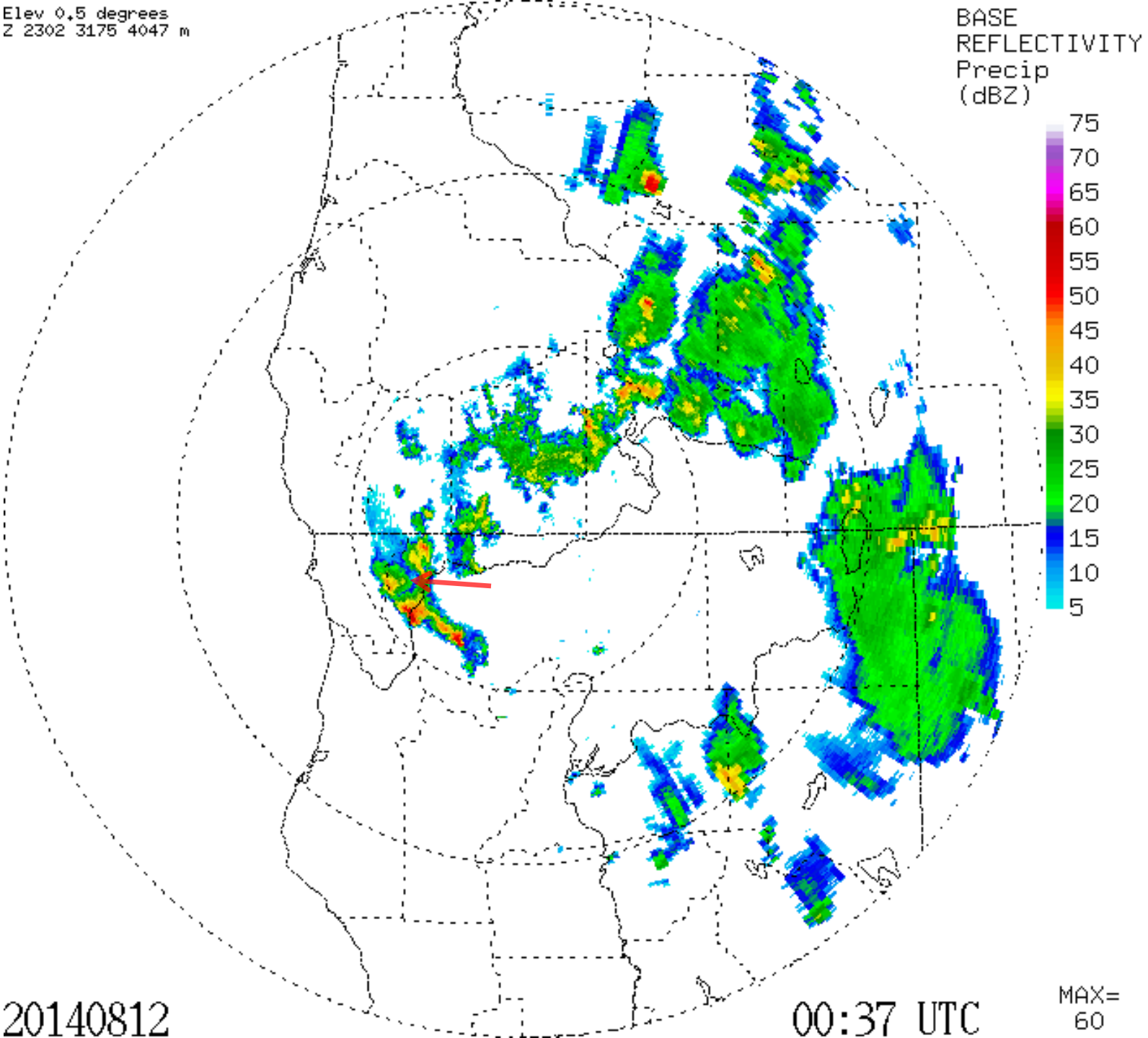
10
5
20140811
23:46 UTC
MAX=
57


Elev 0.5 degrees
Z 2302 3175 4047 m
BASE
REFLECTIVITY
Precip
(dBZ)
75
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45
40
35
30
25
20
15
10
5
20140812
00:37 UTC
MAX=
60

“We’re Going Into Our Shelters Now”

1737 PDT, Monday, 8/11/2014

Div C Supervisor on Command Channel

Beaver Fire – Klamath National Forest, California

For the next 20 minutes, Communications tried every 2 minutes to make radio contact, with no response

Beaver Fire (2014)
Three firefighters entrapped, 2 injured

- Incident Meteorologist (IMET) assigned to fire
- Entrapment happened despite the best of weather information
- Took this one personally
- Wondered for months how these 3 firefighters did not hear the word, when hundreds of others heeded the word

Weatherman Therapy
via the Facilitated Learning Analysis

HEQB (t) and DZOP's Escape Route is Blocked, Hiking Out is Not Feasible: Decision Made to Confront the Fire Where They Were

The current piloted escape route was under construction and still needed significant work. For HEQB (t) and DZOP, this escape route was blocked by the aforementioned farm equipment and vehicles, as well as a small drainage in that same area. (See map on next page.) These obstacles were positioned between the dozer's location to the north and the masticator's location to the south.

HEQB (t) did not believe the dozer could clear its way around the private resident's farm equipment and exit the area quickly enough to avoid the fire, nor that the DZOP would leave his dozer and hike out. Furthermore—with the fire front quickly approaching—he wasn't sure if the DZOP would even be able to make the hike in time even if he was willing to leave the dozer.

Therefore, HEQB (t) went back up the hill with his DZOP and made a plan to construct the incomplete safety zone as large as possible and confront the fire where they were.

Weatherman Therapy
via the Facilitated Learning Analysis

At the same time, all other resources in the area were retreating along their escape routes to safety.

'I Knew This Wasn't Going to Be a Good Deal'

As the rest of the group headed out from DP 76, DIVS C anxiously called HEQB (t) and told him to get he and his dozer operator out of the area *immediately*. It was then that HEQB (t) let DIVS C know that there was no time to get out like the others had done. He explained that they were going to have to stay put and make a safety zone.

DIVS C asked if a truck could make it down the dozer line to them. When HEQB (t) replied that a four-wheel-drive vehicle could make it, DIVS C told OPBD: *"I have to go check on my boys."* OPBD asked if he had a way out, and DIVS C let him know that there were *"some roads down there."*

As DIVS C drove down the dozer line, he was feeling okay [illegible] situation—until about halfway down the line when he noticed the downhill crown run that was [illegible]. He later reflected that, in that instant, he got the sick feeling that: *"This isn't gonna be a good deal."*

They Grab Their Fire Shelters

It took DIVS C [illegible] minutes to drive the 0.7 mile dozer line from DP 76 to the incomplete [illegible]. Once he, too, saw [illegible] the old cars and abandoned [illegible] equipment blocked their only remaining escape route (the [illegible] line downhill from the incomplete safety zone to [illegible] Road, DIVS C [illegible] to the HEQB (t) and said, *"Make it* (the incomplete safety zone) *bigger!"*

There are always more factors than weather,

There are some things over which we have no control

DIVS C holds his fire shelter as the fire advances on their position at 1735 hours.

(This photo was incorporated from the HEQB (t)'s video referenced on next page.)

Frog Fire – July 30, 2015

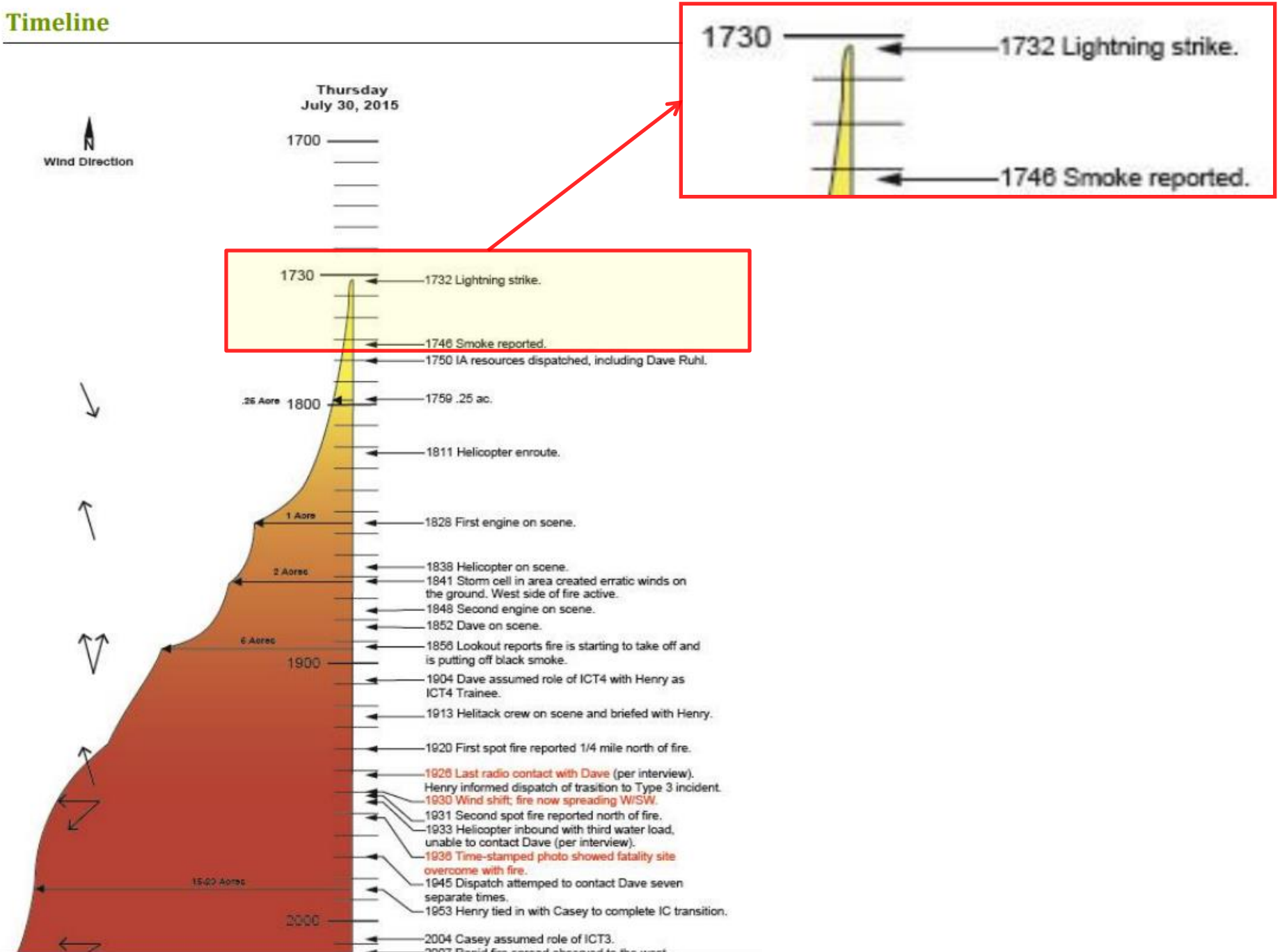
Perspective 1: "Just a normal fire"

Perspective 2: "Fire was pretty straight forward"

Frog Fire – July 30, 2015

Figure 8: Dave Ruhl

Timeline


1730
1732 Lightning strike.
1746 Smoke reported.
Thursday
July 30, 2015
Wind Direction
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1730
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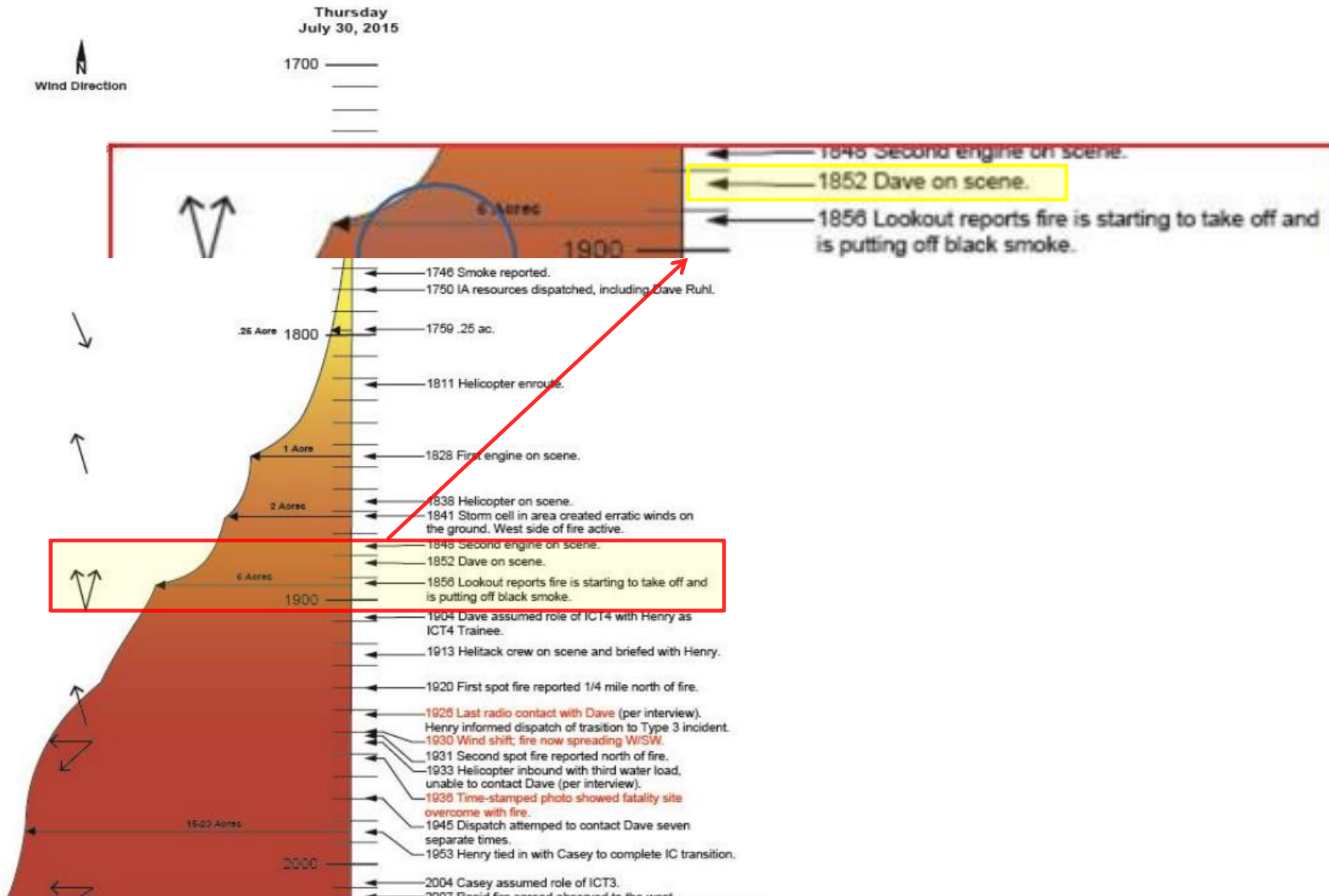
1750 IA resources dispatched, including Dave Ruhl.
.25 Acre
1800
1759 .25 ac.
1811 Helicopter enroute.
1 Acre
1828 First engine on scene.
2 Acres
1838 Helicopter on scene.
1841 Storm cell in area created erratic winds on the ground. West side of fire active.
1848 Second engine on scene.
1852 Dave on scene.
6 Acres
1856 Lookout reports fire is starting to take off and is putting off black smoke.
1900
1904 Dave assumed role of ICT4 with Henry as ICT4 Trainee.
1913 Helitack crew on scene and briefed with Henry.
1920 First spot fire reported 1/4 mile north of fire.
1926 Last radio contact with Dave (per interview).
Henry informed dispatch of trasition to Type 3 incident.
1930 Wind shift; fire now spreading W/SW.
1931 Second spot fire reported north of fire.
1933 Helicopter inbound with third water load, unable to contact Dave (per interview).
1936 Time-stamped photo showed fatality site overcome with fire.
15-20 Acres
1945 Dispatch attemped to contact Dave seven separate times.
1953 Henry tied in with Casey to complete IC transition.
2000
2004 Casey assumed role of ICT3.

Timeline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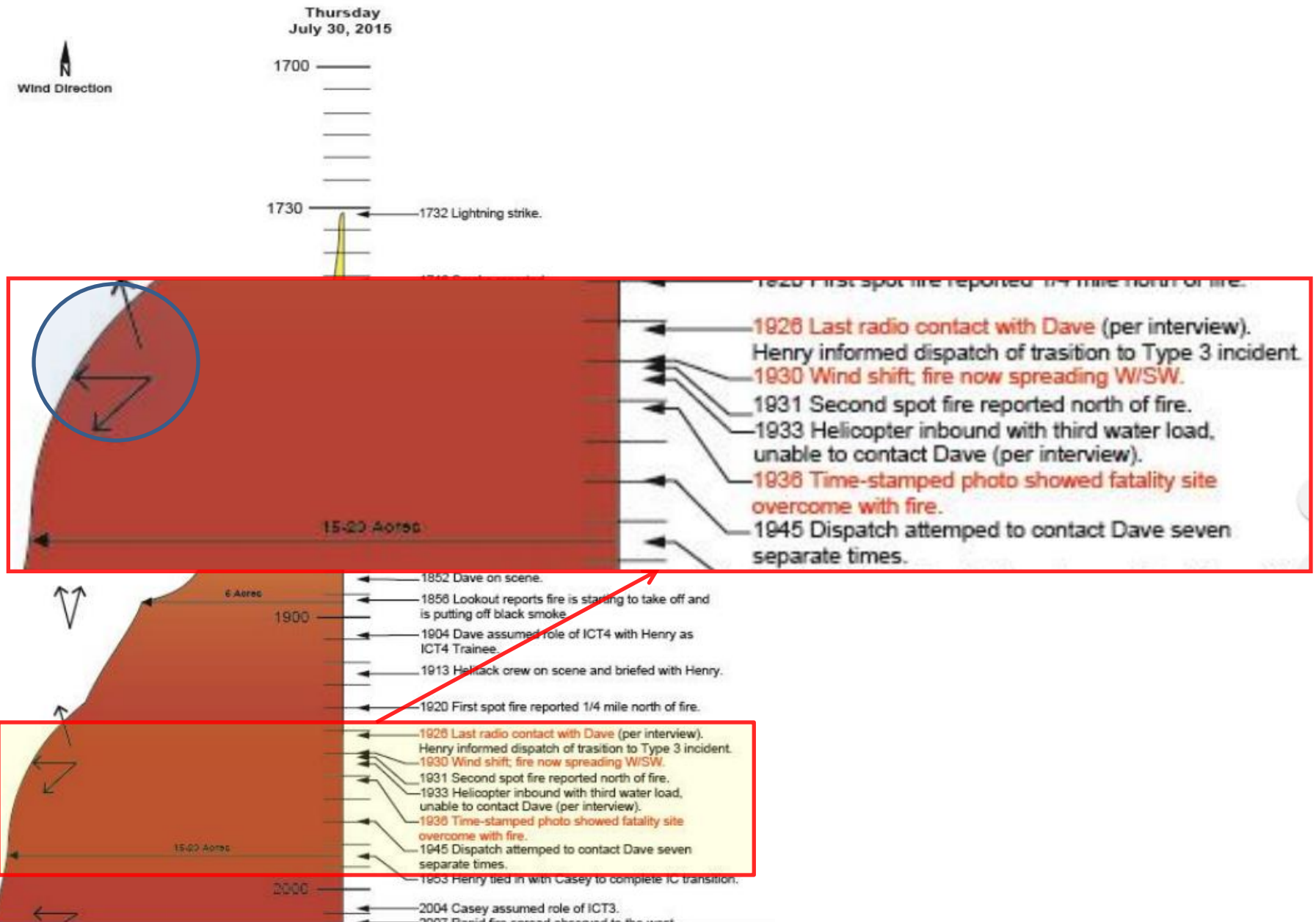
Thursday
July 30, 2015
N
Wind Direction
1700
1730
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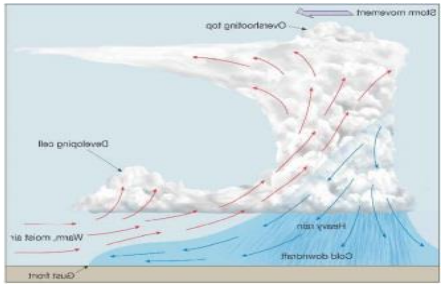
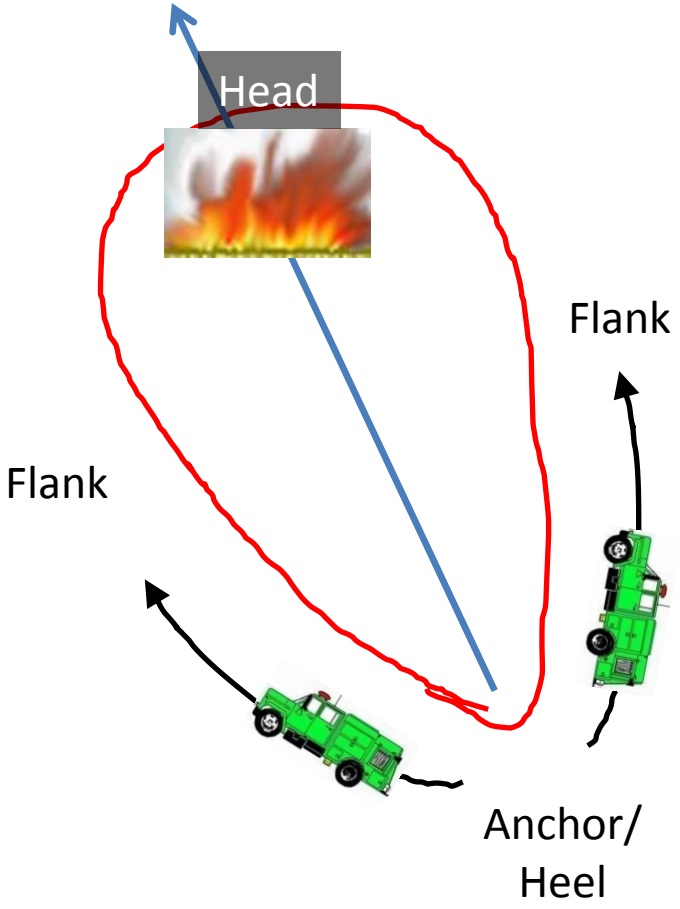
Frog Fire – July 30, 2015

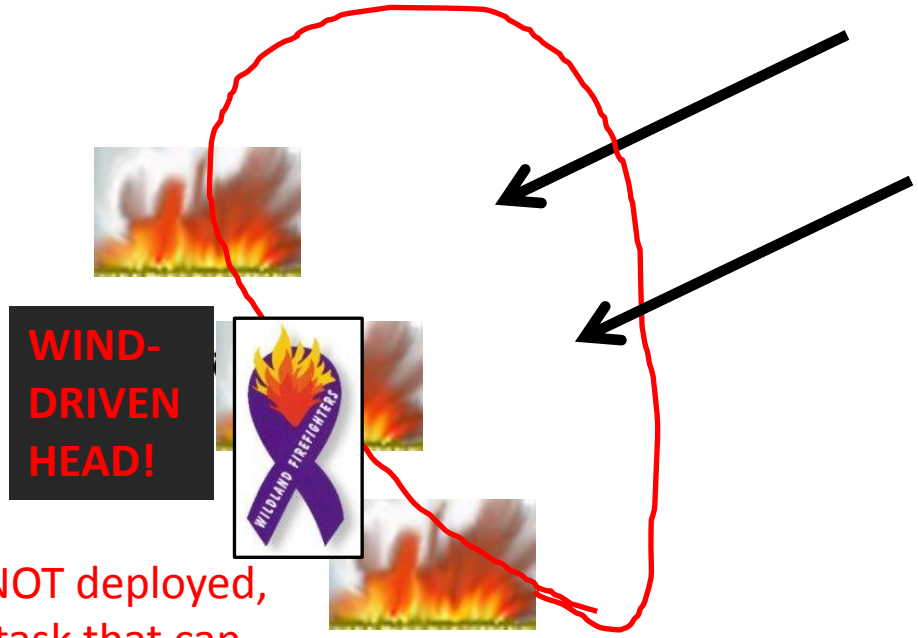
Classic wind shift scenario





Frog Fire – July 30, 2015

Thunderstorm-Induced outflow ***Wind shift***



Fire Shelter NOT deployed, a 30-second task that can *save your life*

10 Watchout Situations Might Have Applied

1. **Fire not scouted and sized up.**
2. In country not seen in daylight.
3. **Safety zones and escape routes not identified.**
4. **Unfamiliar with weather and local factors influencing fire behavior.**
5. Uninformed on strategy, tactics, and hazards.
6. **Instructions and assignments not clear.**
7. **No communication link with crewmembers / supervisors.**
8. Constructing line without safe anchor point.
9. Building fireline downhill with fire below.
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15. **Wind increases and/or changes direction.**
16. **Getting frequent spot fires across line.**
17. **Terrain and fuels make escape to safety zones difficult.**
18. Taking a nap near the fire line.

Twisp River Fire Fatalities and Entrapments

Interagency Learning Review Status Report

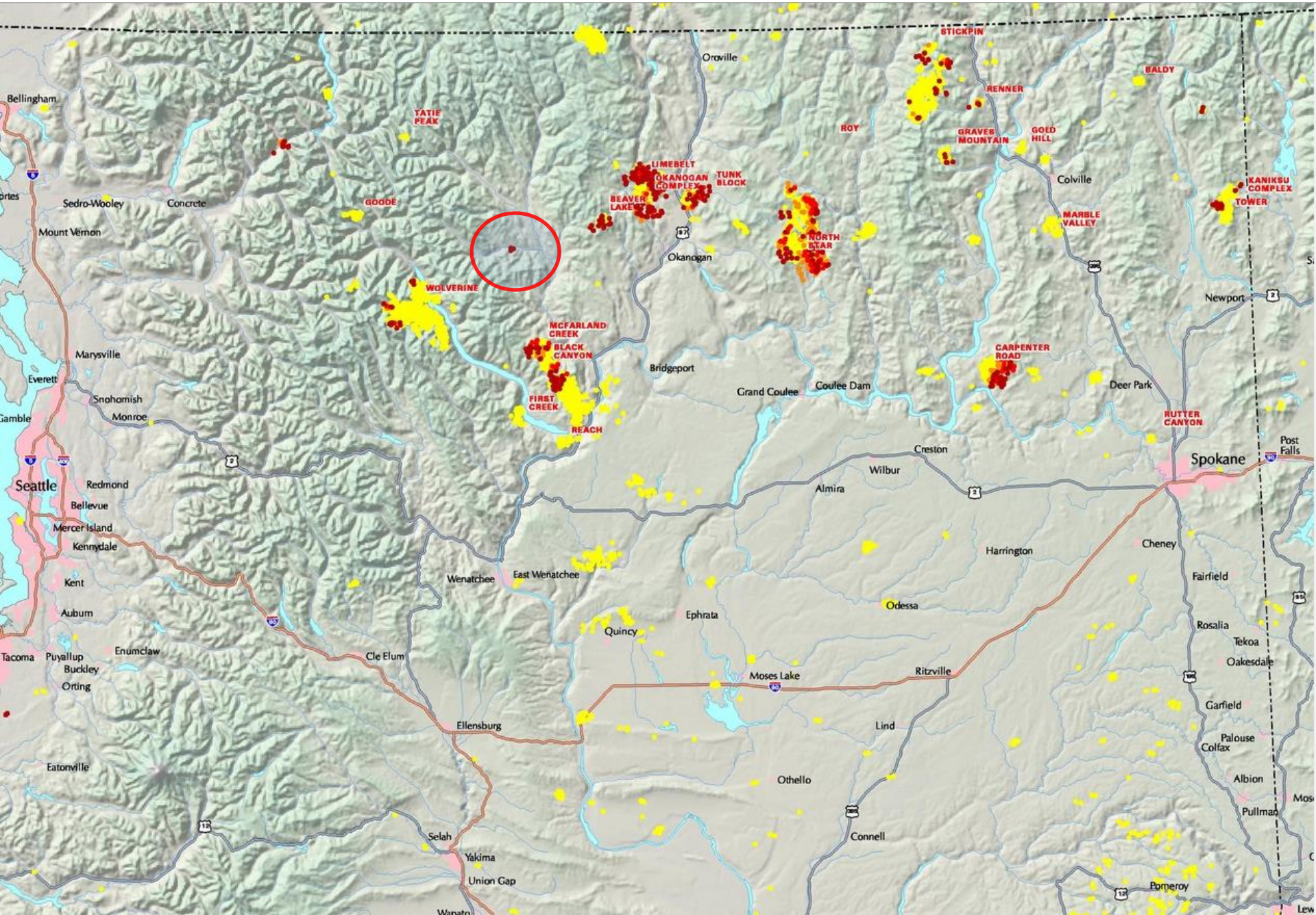
WASHINGTON STATE DEPARTMENT OF
Natural Resources

FOREST SERVICE
U.S.
DEPARTMENT OF AGRICULTURE

Purpose of the Status Report

On August 19, 2015, the Twisp River Fire (Twisp) in the State of Washington tragically cost the lives of U.S. Department of Agriculture, Forest Service firefighters Rick Wheeler, Andrew Zajac, and Tom Zbyszewski. The fire also severely injured another Forest Service firefighter and resulted in the injury of three other firefighters[1] working for the Washington Department of Natural Resources. As we started reviewing this event, it became apparent that more lives could have been lost.

MODIS Fire Detection Image, 1700 PDT on 8/19/2015, credit USFS



The first firefighters on scene stated they saw three- to four-foot flame lengths at the head of the fire. The fire was terrain driven; the wind was light out of the southeast; and the fire was roughly two to three acres in size. As the fire progressed, the fire on the left side burned more quickly. This rate of spread was mainly due to the uphill slope on the left side

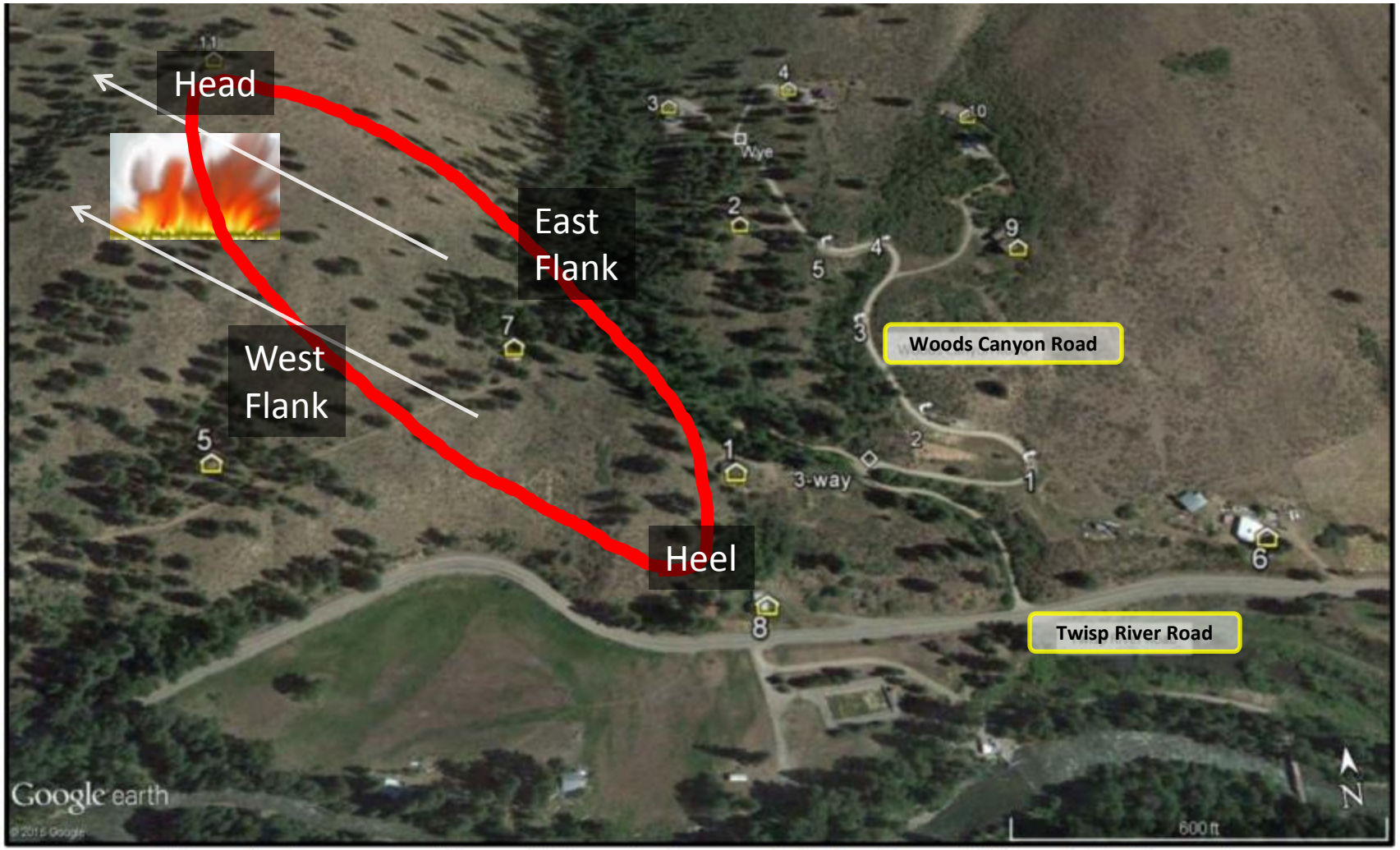


Figure 4—Area map with vegetation; staging area is below house 8 (Google Earth map).

The initial tactical plan that the ICs agreed on was a standard one. Their objectives were to protect life first, then property. The firefighters would "anchor and flank the fire, going direct." This means that the firefighters would start at the safe, already burned area at the heel of the fire and work their way around the fire, staying as close to the black (burned) area as possible. The fire was divided into a right side or flank and a left side. "Points of contact"[5] were identified as the leaders for each side (flank) of the fire and given resources to employ to suppress the fire. There were structures threatened on both sides of the fire.

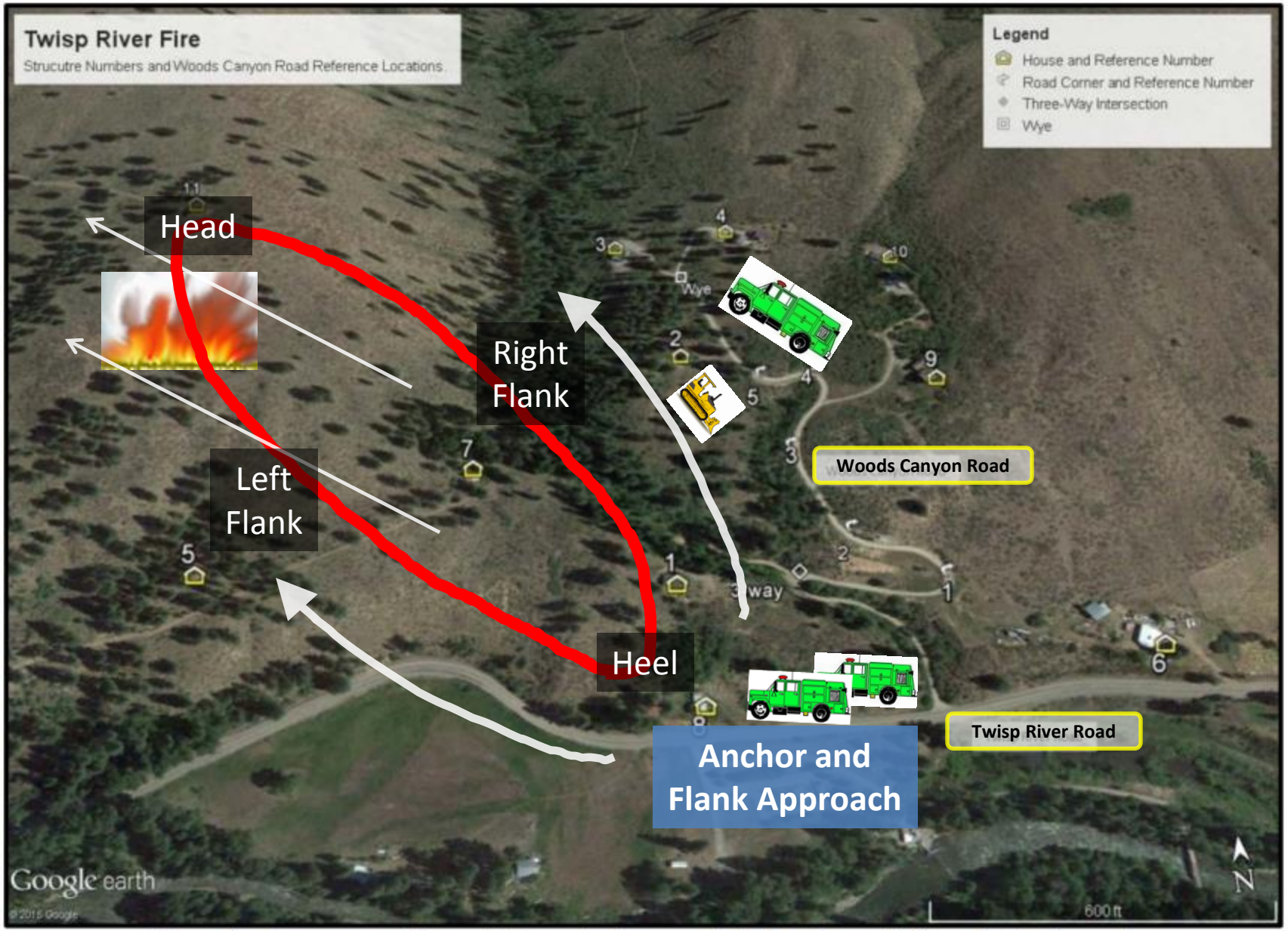


Figure 4—Area map with vegetation; staging area is below house 8 (Google Earth map).

Meanwhile on the left side of the fire, some of the firefighters noticed the smoke column shift from leaning over their flank of the fire to standing straight up. They also noted that

the wind had changed direction. The engines continued to work on putting out spot fires and noticed the work got slightly easier. The left flank "point of contact" recalled:

"Around 1445 I looked up and saw Air Attack and thought, 'That's weird.' I felt little wind and there was a forecasted wind [shift] out of the west that morning. We talked about it at some point in the day, so a lightbulb went off that this was probably the wind switch. I stood there and watched. My flank of fire had calmed down and was no longer the priority. I noticed the smoke starting to blow the other way; [it] wasn't cranking, but I got the feeling things [were] changing."

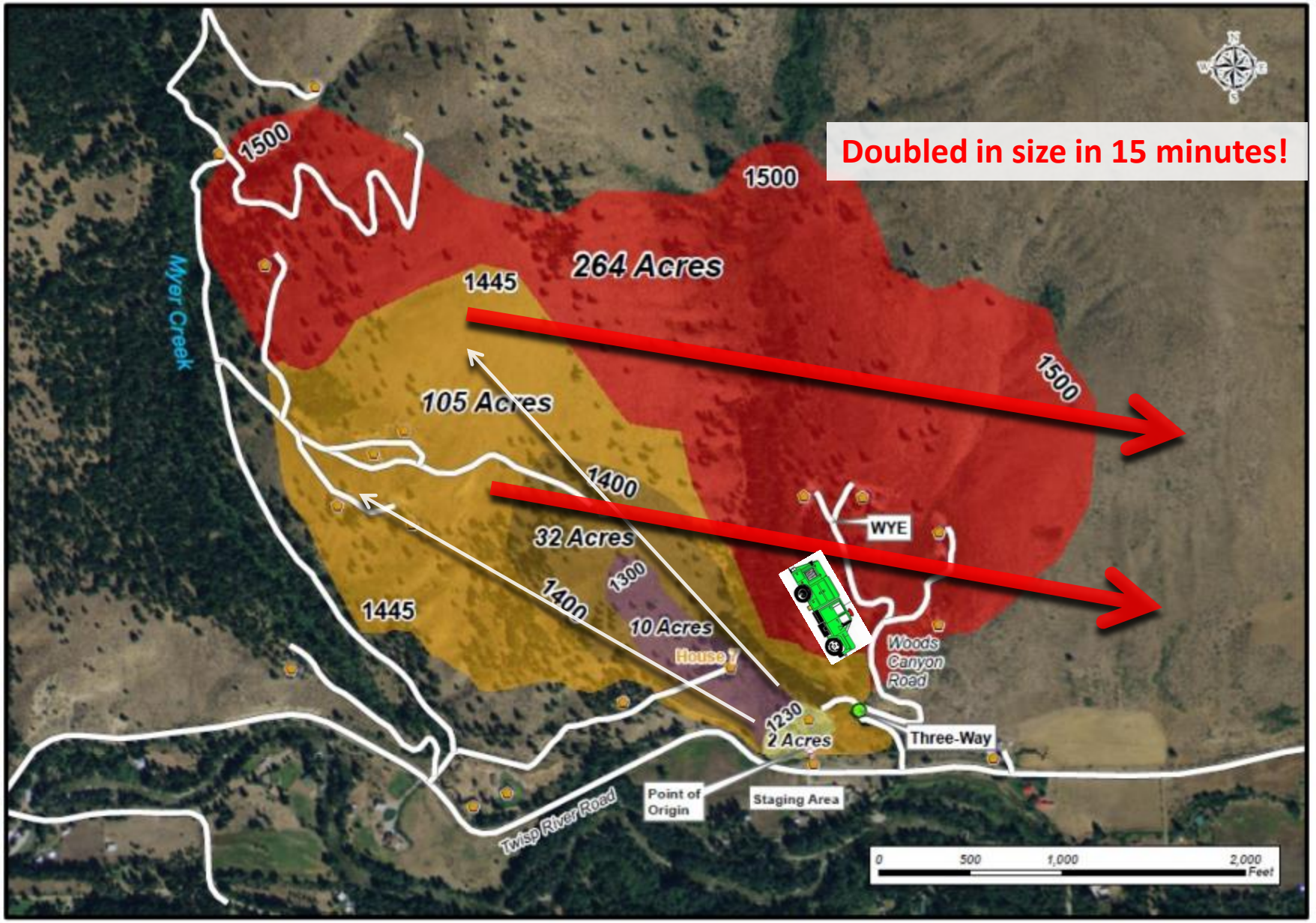


Figure 2—Estimated progression map from 12:30 p.m. to 3:00 p.m. (1500) of the Twisp River Fire on August 19, 2015.

As the right side "point of contact" was briefing an additional incoming engine at the "Y" (referred to as "Wye" on maps, Figure 4), the fire behavior drastically increased. The wind had shifted and increased speed. Correspondingly, extreme fire behavior was observed, which astounded even the most experienced firefighters at Twisp. Several firefighters reported the winds seemed more like a "strong breeze" than a heavy wind, adding to the surprising nature of the increased fire behavior.

One firefighter in the area saw the Engine 642 crew members scramble to get into their truck. He watched them drive up the road in the opposite direction of their safety zone. He noted there were 60-foot flame lengths and could feel the heat as the fire licked over house 2 moments after Engine 642 left. This firefighter, who was in his ninth year of firefighting in the local area, stated, "I have never seen fire move this fast."

The right side "point of contact" saw Engine 642 driving up to him, so he whistled and swung his hand over his head, indicating they needed to turn around and get out. The "point of contact" yelled, "RTO! [Reverse tool order!]," meaning that all crews needed to follow their escape route back down the road to the safety zone. Engine 642 turned around in the road and was the first engine to head toward the escape route. One of the other 3 engines turned around at the "Y," and another engine drove up to house 4 to turn around. The fourth engine remained at house 3.

As Engine 642 drove down toward the safety zone, the road was completely obscured by smoke. The engine jolted and dropped down as if a tire had popped. They kept driving downhill, but they had zero visibility, and the engine went off the road. The engine came to a stop, and the surviving firefighter got out and was immediately engulfed in flames. He went through the flames and made his way to the road.

The surviving engine crews said they had never seen or heard anything like the fire behavior they experienced. They could not hear anything due to the deafening noise, which one firefighter described as, “like a giant TV tuned to static and turned up full blast.” As one engine recounted their retreat to safety, “the smoke conditions were black as night, and at one point fire was over the top of the engine.”

Further up Woods Canyon Road at house 3, the dozer group saw fire licking around the side of the house. The dozer operator still inside the open-cab dozer was not overly concerned and thought the crew could ride out the fire near the house. Soon, the cab of the dozer became too hot to stay in. The operator shut down the dozer but did not take his fire shelter because it was attached with a bungee cord to the dozer cage, and he did not think he would need it.

The three dozer crewmembers initially huddled between the garage and the dozer, but as it got hotter they pried open the roll-up garage door and went into the garage. Eventually they realized the structure was on fire, and it began getting hot in the garage. They called on the radio for the engine nearest to them to spray water on the garage, but they did not receive a response. They could not hear anything on the radio due to the deafening noise.

The engine crew at house 3 used most of its water to cool down the advancing fire; they targeted the house, dozer, and a small group of trees near the house. The engine crewmembers could no longer see the dozer crew, and in fear for their own lives, headed down the escape route. It was incredibly hot and smoky inside the cab of the engine, and they had to make their way down the road in "little chunks," waiting for visibility to improve and the temperatures to cool down enough to continue driving.

This engine could have suffered the same fate!

The dozer crew had chosen to ride it out in the garage and did not feel abandoned by the engine that left the scene. Eventually, the three recognized that the garage was on the verge of collapse, so they opened the garage door and moved behind the dozer to shield themselves from the heat. It was immediately apparent that this was not enough

protection, so they moved quickly to the "Y" to deploy their fire shelters. The three men fit into two shelters (Figure 7).

Figure 7—A depiction of how the dozer group was oriented while in the two shelters. The remnants of house 3 and dozer are in the background of the photo.

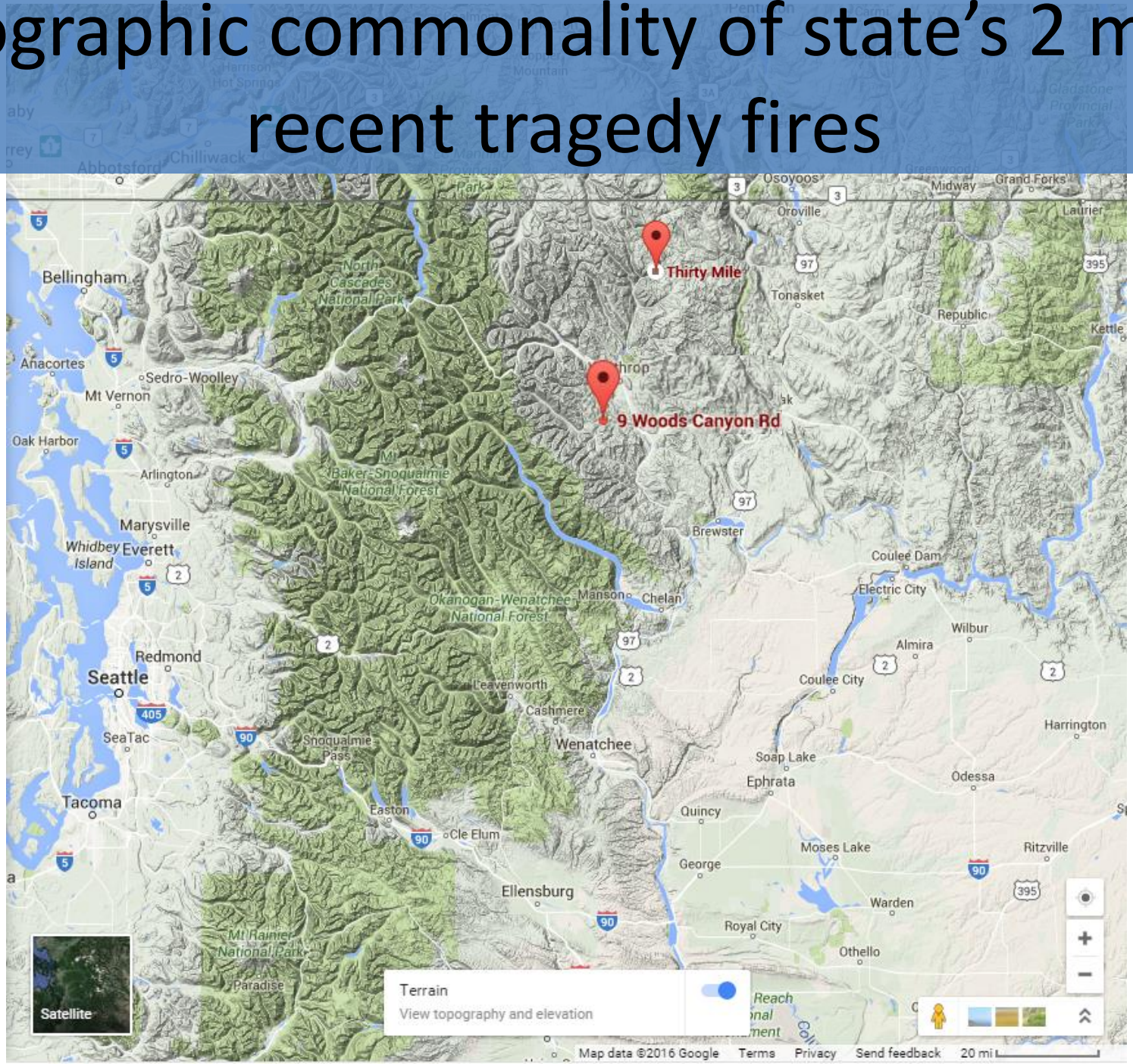
As bad as the Twisp River Fire was, it could have been even worse

Could have been 11 fatalities

Summary of Commonalities

Fire	< 24 hours old?	Weather Contribution?	Valid Spot Forecast?	Other Contributions?
Thirtymile – 2001, WA	**Yes**	**Yes** - *instability*	**No**	**Yes**
Yarnell Hill – 2013, AZ	**Yes**	**Yes** - *wind shift*	**Yes**	**Yes**
Beaver Fire – 2014, CA	**No**	**Yes** - *wind shift*	**Yes**	**Yes**
Frog Fire – 2015, CA	**Yes**	**Yes** - *wind shift*	**No**	**Yes**
Twisp River – 2015, WA	**Yes**	**Yes** - *wind shift*	**No**	**Yes**

Geographic commonality of state's 2 most recent tragedy fires

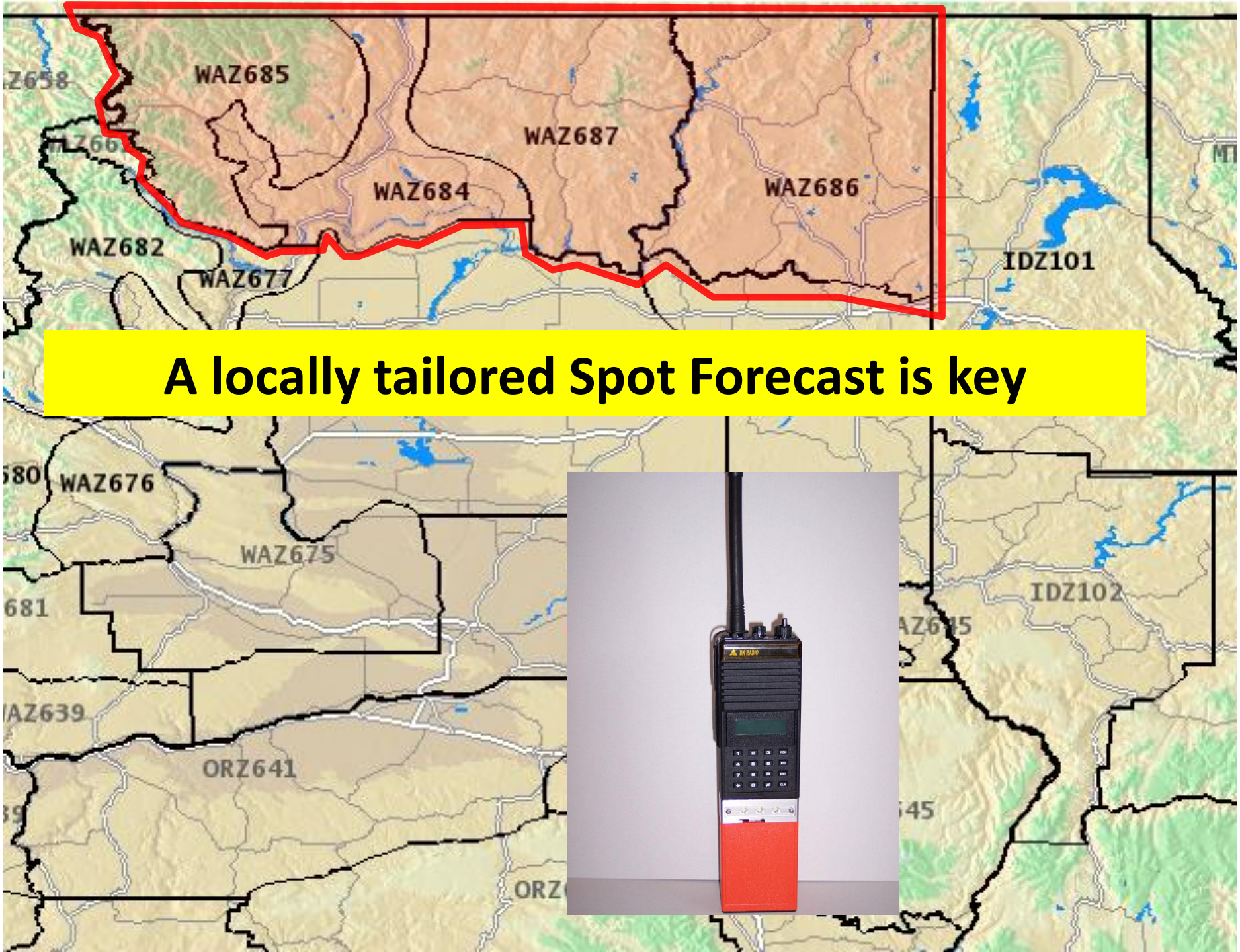


What weather information was being used at the Twisp River Fire?

the location of the fire was plotted, this frequency confusion had to be sorted out. As the ICs organized to fight the fire, they began ensuring that the many resources they were leading had the correct frequencies programmed into their radios so everyone could communicate effectively (no reprogramming was necessary).

Dispatch held the departure of the fixed-wing aerial resources (tankers and lead plane) at the airport until the air attack reported on scene. Ground resources and air attack were unaware that the fixed-wing resources were being held. When air attack arrived over the fire, the pilot noticed a lot of up-air—more than he had ever experienced before. He later wondered if the up-air he experienced was a precursor to the extreme fire behavior event to come.

Some resources on the fire had access to the general fire zone forecast read over the radio that morning. Several firefighters were reassigned from other fires in the area where they had received a more locally specific fire weather forecast for the Chelan Complex, which was located about 40 miles away from Twisp. This localized forecast predicted a wind shift between 3 and 5 p.m. The ICs did not have access to this forecast. Other firefighters who had that information may have discounted the weather information based on their individual experience with perceived weather forecast inaccuracies in that area.


WAZ685
WAZ687
WAZ684
WAZ686
WAZ682
WAZ677
IDZ101
A locally tailored Spot Forecast is key
WAZ676
WAZ675
IDZ102
ORZ641

Chelan Complex Forecast Briefed by an NWS Incident Meteorologist (IMET)

"We've got your back!"

(Disclaimer: Photos from California, *not* from the Chelan Complex)

FIRE WEATHER FORECAST

FORECAST NO. 16

NAME OF FIRE Wolverine/Blankenship/Chelan Complex
First Creek/Black Canyon & McFarland Creek **PREDICTION FOR:** Wednesday, August 19, 2015

UNIT: Okanogan-Wenatchee National Forest

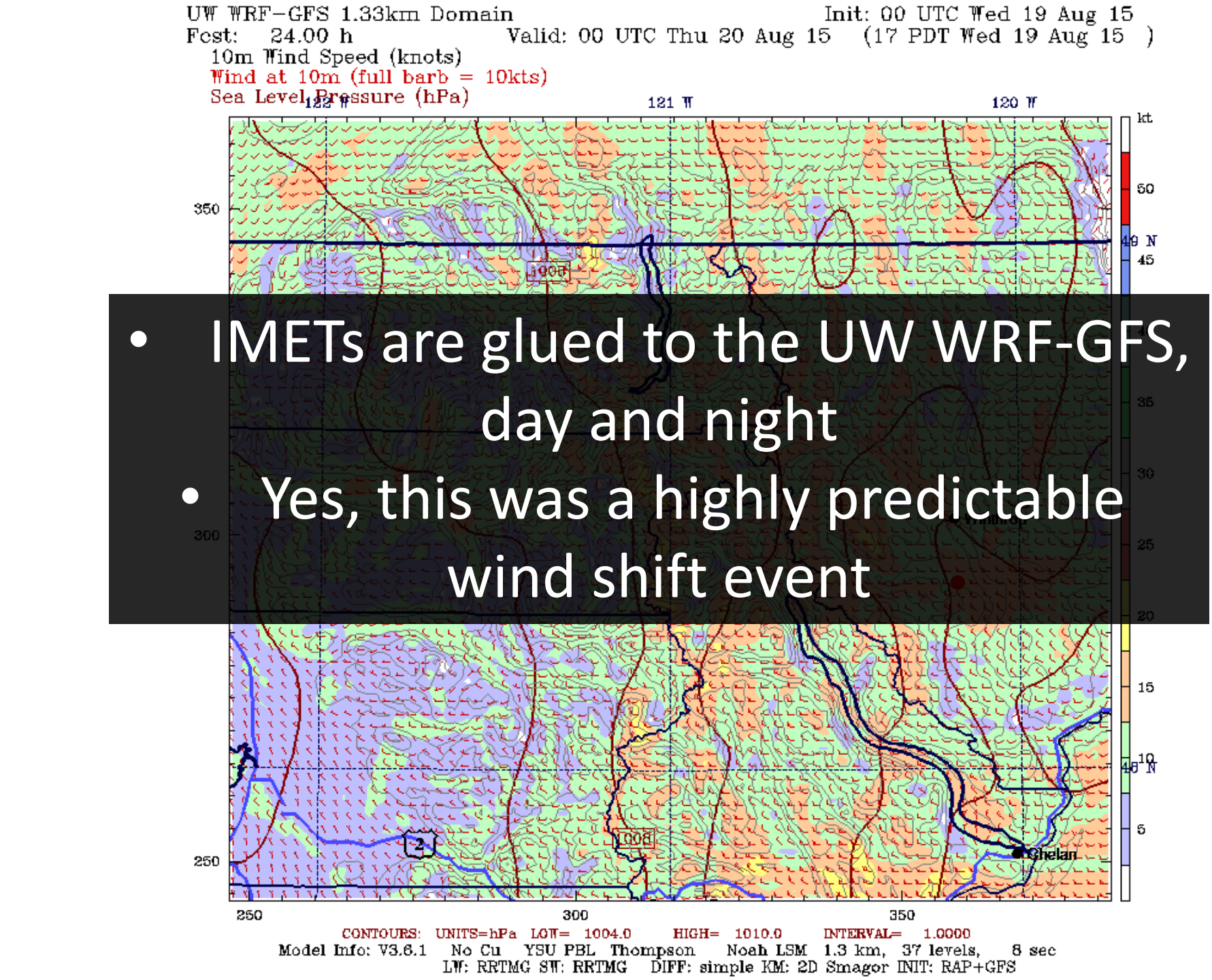
TIME AND DATE
FORECAST ISSUED: 2000 Tuesday 8/18/15

SIGNED: _____
Andy Gorelow (T) / Julia Ruthford
Incident Meteorologists

WEATHER DISCUSSION: Very warm temperatures along with low relative humidities will be seen Wednesday ahead of a system that is expected to move through the region Thursday and Friday. Northwest winds will start to increase late Wednesday and become stronger Thursday and Thursday night. A cold front will move through the region early Friday morning bringing with it very little moisture…however there will be a slight chance of thunderstorms Friday.

*****Red Flag Warning for Hot…Dry and Unstable Conditions from 1100 Wednesday to 1700 Friday*****
Gusty Northwest Winds Thursday…Thursday Night and Friday…

WEDNESDAY:
WEATHER: Mostly Sunny.
MAXIMUM TEMPERATURE: 88 to 93 from 1000 to 3000 ft and 75 to 80 ridges from 6000 to 8000 ft.
MINIMUM RELATIVE HUMIDITY: 14 to 19% 1000 to 3000 ft and 23 to 28% from 6000 to 8000 ft.
20 FOOT WINDS:
Lake Chelan and Adjacent Slopes…Light Northwest 3 to 5 mph in the morning…becoming South 8 to 12 mph after 1000. .then shifting to the Northwest 15 to 20 mph after 1700.
Railroad Creek area including Holden…West 3 to 5 mph in the morning…becoming East 7 to 10 mph after 1000. Then becoming West 12 to 17 mph after 1500.
Stehekin…Northwest 3 to 5 mph becoming Southeast 5 to 8 mph after 1000. Winds shifting Northwest 10 to 15 mph after 1500.
Chelan Complex…Southeast to South 4 to 7 mph…becoming southwest 8 to 10 mph after 1500. Winds shifting to the Northwest 10 to 15 mph after 1700.
First Creek…Northwest 3 to 5 mph…becoming Southeast 8 to 10 mph by 1100. Winds shifting Northwest 10 to 15 mph after 1700.
Black Canyon and McFarland Creek…East/Southeast 6 to 8 mph becoming West/Northwest 10 to 15 mph after 1700.
STABILITY: Valley inversions lifting in the morning by 1000. Unstable in the afternoon.
HAINES INDEX: 5 **CHANCE OF WETTING RAIN:** 0% **LAL:** 1



- IMETs are glued to the UW WRF-GFS, day and night
- Yes, this was a highly predictable wind shift event

The Routine, Official Way:

Spot Forecast requested at 737 pm on 8/19

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SPOT FORECAST FOR TWISP  RIVER...USFS
NATIONAL WEATHER SERVICE SPOKANE WA
829 PM PDT WED AUG 19 2015

FORECAST IS BASED ON REQUEST TIME OF 2038 MDT ON AUGUST 19.
IF CONDITIONS BECOME UNREPRESENTATIVE...CONTACT THE NATIONAL WEATHER
SERVICE.

.DISCUSSION...

...RED FLAG WARNING IN EFFECT UNTIL FRIDAY 11 PM FOR BREEZY AND
DRY CONDITIONS THURSDAY AFTERNOON...AND WINDY CONDITIONS ON FRIDAY...

HIGH PRESSURE MOVES EAST TONIGHT. EXPECT CONTINUED BREEZY CONDITIONS
EARLY THIS EVENING...BEFORE ABATING THROUGH THE LATER PART OF THE
EVENING INTO THE OVERNIGHT. HOWEVER THEY WILL REMAIN SUSTAINED AROUND
10 MPH FROM THE NORTHWEST. THE COLD FRONT APPROACHES LATER
THURSDAY AND WINDS ARE EXPECTED TO TAKE A WEST OR WEST-SOUTHWEST
COMPONENT THROUGH THE AFTERNOON. THURSDAY NIGHT INTO FRIDAY THE COLD
FRONT PASSES...GENERALLY BETWEEN LATE EVENING EARLY FRIDAY MORNING...
AND THE WINDS TURN NORTHWEST AND SPEEDS AND GUSTS INCREASE...
ESPECIALLY NEAR THE HIGHER ELEVATIONS. WINDS ARE EXPECTED TO
REMAIN STRONG THROUGH FRIDAY AFTERNOON...BEFORE SLOWLY ABATING
FRIDAY EVENING INTO SATURDAY MORNING.

A THREAT OF SHOWERS AND THUNDERSTORMS WILL ACCOMPANY THE COLD FRONT
AS WELL...THOUGH THE BETTER THREAT WILL BE AROUND THE SURROUNDING
HIGHER TERRAIN. CHANCES WILL START MAINLY THURSDAY OVERNIGHT
AND CONTINUE THROUGH FRIDAY...BEFORE THE THREAT WANES IN THE EVENING.

.TONIGHT...

SKY/WEATHER.........PARTLY CLOUDY. AREAS OF SMOKE.
CWR.................0 PERCENT.
MIN TEMPERATURE.....56.
MAX HUMIDITY........59 PERCENT.
WIND (20 FT)........NORTHWEST WINDS 8 TO 14 MPH. GUSTS UP TO 25 MPH
                    BEFORE 10 PM
MIXING HEIGHT.......5000 FT AGL EARLY IN THE EVENING
                    DECREASING TO NEAR THE SURFACE AFTER 9 PM.
TRANSPORT WINDS.....NORTHWEST 13 TO 17 MPH.
LAL.................1.
HAINES INDEX........5 MODERATE.

.THURSDAY...

SKY/WEATHER.........PARTLY CLOUDY. AREAS OF SMOKE.
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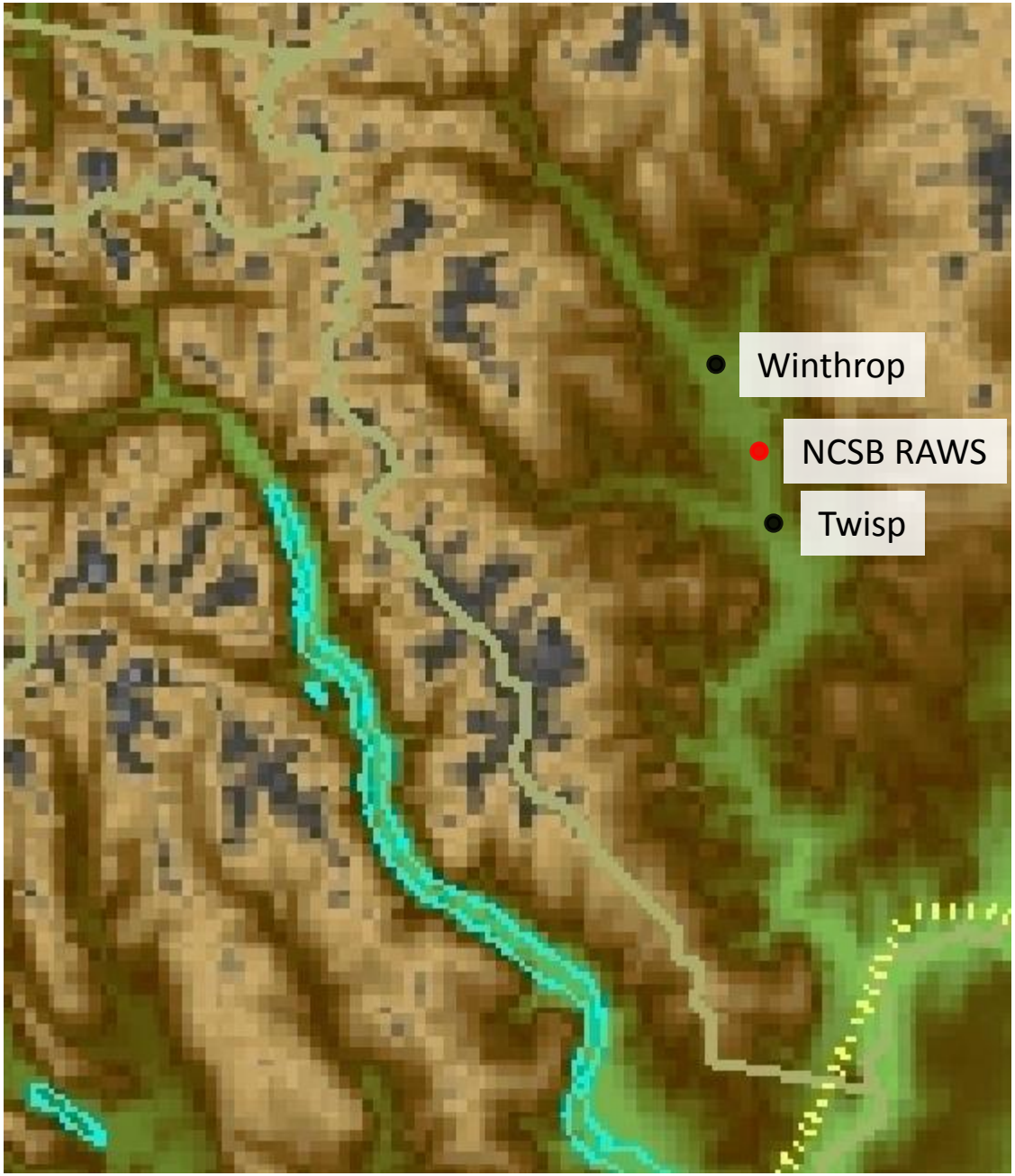
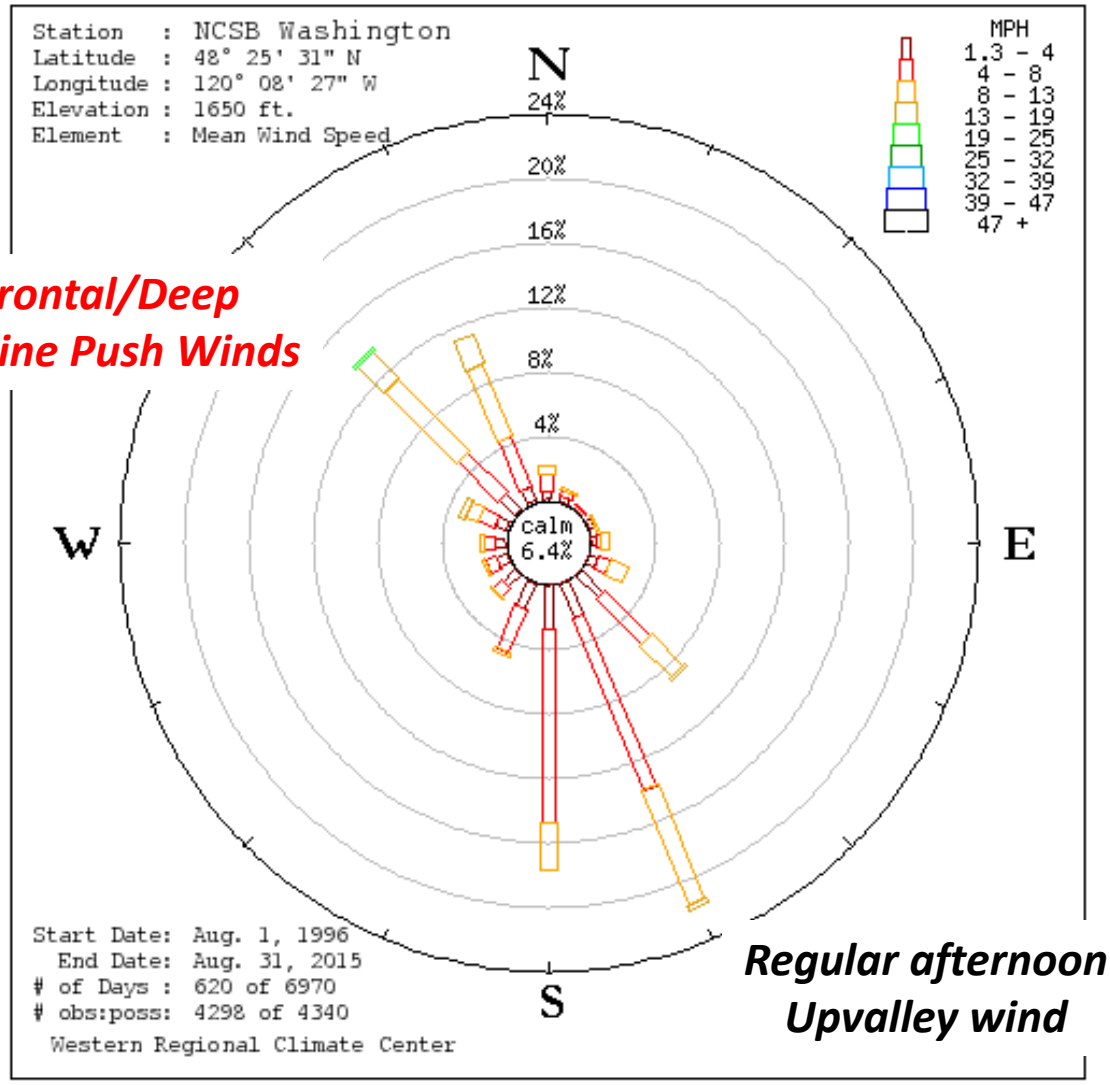

Winthrop
NCSB RAWS
Twisp

Wind Rose – August, 1200-1800

NCSB Washington



Frontal/Deep Marine Push Winds

Regular afternoon Upvalley wind

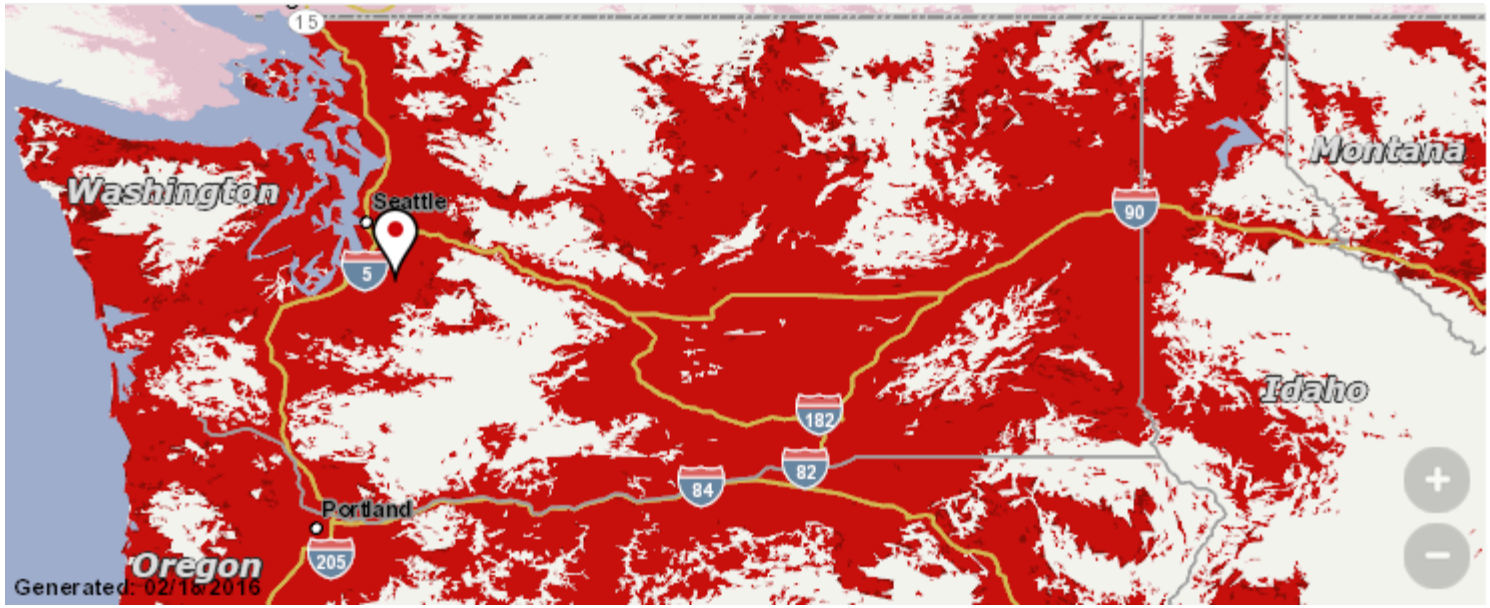
Moving Forward – Our Greatest Weather Challenge in Ensuring Firefighter Safety

Through innovation, find ways to get constantly updating, pertinent, and critical short-term forecasts directly **into firefighters' hand *before* their arrival on a new fire**

Challenges of Delivering Weather Info

- New technology does not work in the state's most unforgiving locations

Verizon Coverage Map



Challenges of Delivering Weather Info

- Lack of Direct Interaction with Firefighters going to new fires
- Rely on Dispatchers as Our Mouthpiece
  - In unusual circumstances, it can create an additional point of failure

Challenges of Delivering Weather Info

- Traditionally, NWS not aware of most fires until a Spot Request arrives hours later
  - But social media is changing that

Challenges of Delivering Weather Info

NWS became aware of fire using Radar.

No Spot Request, meaning no 2-way communication between fire and NWS

E-Mail to me from Forecaster Amanda Graning, NWS Duluth

As for my idea - your assumption is absolutely correct. It was a near miss- of near misses and miracle no lives were lost. They had to relocate the ICP since the dramatic change in weather/fire behavior was not anticipated/understood. For several hours prior to the front arrival we (my WFO and I) were calling 911 and everyone we could think of to get a hold of someone at the fire, since they had not requested a SPOT, and it was very obvious what was going to happen. Actually pretty cool radar images since it was only 40 miles from Duluth.

Challenges of Delivering Weather Info

- It’s a seasonal business
  - Employee turnover
  - Education and annual re-education
  - Will personally spend about 35 days on the road this spring providing weather training to firefighters

Challenges of Delivering Weather Info

We Can Be Our Own Worst Enemy

- Over-use of technical weather jargon
- Not always making the important stuff stand out
- Consistency of message: Is a 10 mph wind a “strong wind” or “not a big deal”?

Innovation Brainstorming

- Quandry
  - Necessity of Old Technology
  - Capabilities of New Technology

Ongoing Innovations

- Daily YouTube Fire Weather Briefings
  - Started at NWS Seattle in 2015 season
  - Became the weather briefing of choice for a few engine crews on Mt. Baker-Snoqualmie N.F.
  - One Fire Chief told me he would use this as justification to purchase a Tablet for each of his fire engines

Ongoing Innovations

Color-Coded Products

South Complex Fire Weather Outlook

For Planning Purposes Only, see the IAP for the Official Forecast

Forecast made Aug. 3 @ 1930 - Incident Meteorologist (IMET) Andy Haner

	Tue	Wed	Thu	Fri	Sat	Sun
	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug
Max Temp (°F), 2000'	93	93	97	91	86	86
Min RH at 2000'	27%	28%	17%	28%	36%	32%
CWR (%)	0	0	0	40	20	0
PM Cloud Cover (%)	20	20	10	60	40	20
LAL	1	1	1	3	2	1
Ridge Wind (mph)	14	12	8	10	10	14
Wind Direction	NW	NW	NW	NW	NW	NW

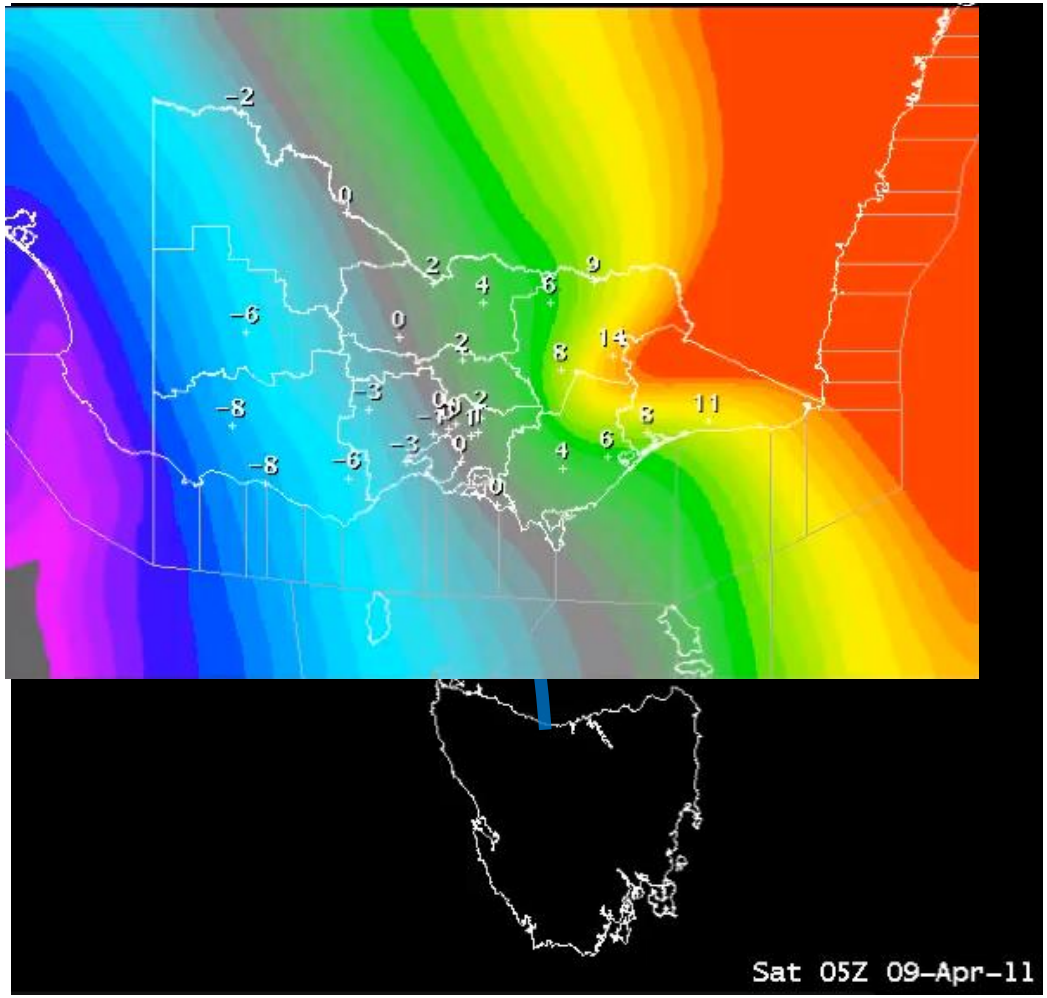
Brainstorming Future Innovations

- Embed audio files with Spot Forecasts?

- More communication training to meteorology students pursuing an “Applied Option” Bachelor’s Degree

Brainstorming: Future Innovations

Australian-style “Time of Change chart”?



Brainstorming: Looking for a Grad Student Project?

- A Challenge to You!
- **Develop an app** for dispatchers / fire lookouts that warns of imminent, sudden wind shifts on new fires
  - Would send an alert when a sudden, strong wind shift is expected in the next 3 hours
  - Could run off an hourly updating storm-scale model, such as the HRRR
  - Existing wind shift algorithms could be adapted

Brainstorming: Future Innovations

- Have Ideas? Let’s talk over lunch.

Summary –
When Weather is a Factor in Tragedy,

- Weather is *just one* of several factors
- Good weather information delivered effectively *can* make the difference
- At times, the best weather information is not enough (some things are out of our control)

Summary –
What *is* in our Control?

- Recognizing A Key Pattern:

- A startling number of weather-related entrapments occur following **Wind Shifts during the first 24 hours of a fire's start**

Summary – Fire Weather's Greatest Challenges

- Getting constantly updating, pertinent, and critical short-term forecasts directly **into firefighters' hand *before* arrival on a new fire**

- This is where future research, development and outreach efforts need to be directed

Gratuitous YouTube video
from Beaver Fire

- https://www.youtube.com/watch?v=MYENvpiv1WA&feature=youtu.be

- 2:55-5:10

Tragedy Fires: What Can We Learn in the Weather Community?

Andy Haner
Forecaster / Incident Meteorologist
NOAA – National Weather Service, Seattle